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Ericsson's New Caloric Pumping Engine.

The cut on this page represents Ericsson's New Caloric Pumping Engine, which is specially intended for domestic use in lifting water from wells, cisterns, ponds and brooks, or from Croton pipes to water tanks on upper floors of buildings in city or country.

It is the invention of Capt. John Ericsson, the inventor of caloric engines, and of the original "Monitor" system of iron clads, which first came into prominence at Hampton Roads, and figured so largely throughout the late civil war.

This pumping engine is entirely safe, no steam being employed, and is not liable to derangement. When used for pumping water for dwelling houses and country seats it may be operated by servant girls. It does not increase insurance, as it has neither boiler nor steam.

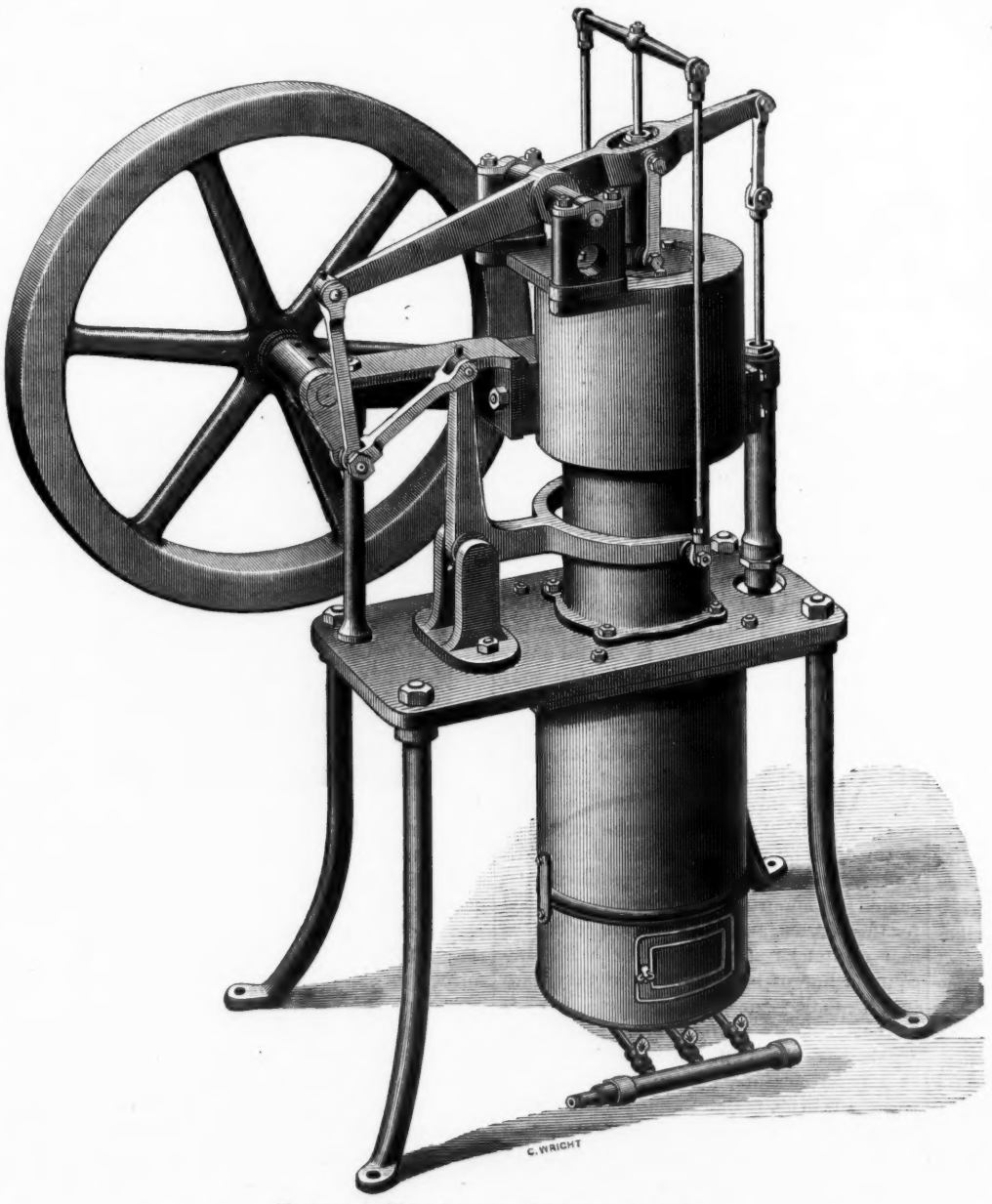
All kinds of fuel will answer for this engine, but coal gas is preferable, the consumption being only 15 cubic feet per hour; besides, gas is handier and cleaner than coal or other combustibles.

For the present two sizes are being manufactured as follows: 8-inch cylinder, pumping 350 gallons per hour, and 6-inch cylinder, pumping 200 gallons per hour, using either gas or coal furnace. These pumping engines can be used successfully against a head of 150 feet.

The engine is noiseless and without valves of any kind, the piston being moved by the alternate heating and cooling of the atmosphere. It occupies a space on the floor of 39 × 20 inches over all, and is 48 inches high.

For use in private dwellings in city or country it illustrates in the highest degree, simplicity combined with practical utility. The machine is a grand study for young engineers, who are too apt to abandon simplicity for complication.

The engine has but one cylinder, which is of uniform diameter, the bottom being closed and cast solid with the cylinder; the furnace is attached below the cylinder. The heat is applied to the cast iron bottom of the cylinder, which heats and expands the air within. The same air is heated over and over again, there being no valves, as previously stated. The air is cooled in the upper part of the cylinder by means of a water jacket enclosing it. The water from the pump passing through the jacket is discharged through the discharge pipe leading to the tank. This novel pumping apparatus is manufactured and sold by the Delamater Iron Works, 10 Cortlandt street, New York City.



ERICSSON'S NEW CALORIC PUMPING ENGINE.

The so-called "strike" of the iron puddlers in West Pennsylvania and Ohio is neither a strike nor a lock-out, but may be called a dead-lock. It is customary for the manufacturers to sign an agreement with the puddlers the 1st of June every year, but so far the two parties this year have failed to agree. At this writing, the puddlers seem to have the advantage in the controversy.

Steam on the Canals.

BY W. H. ODELL, M. E.

Some time since, Mr. Horatio Seymour, Jr., State Engineer and Surveyor, determined to ascertain what the difficulties are in the way of the successful application of steam to propel boats on the Erie Canal.

In order the better to understand the difficulties the canal boatmen have to contend with, he, with the assistance of the division engineers of the various divisions of the canal, and a mechanical engineer employed for the purpose, concluded to make a personal examination, and note every obstacle encountered by a steam canal-boat on a regular trip through the entire length of the canal, and then down the Hudson River to the dock at New York. During this trip a strict watch was kept day and night, and a great amount of valuable data was obtained; and believing that an account of this trip will be interesting to many of your readers, as well as to the various boards of trade and commerce that gave it their countenance and encouragement, I will try to briefly put it in shape to be understood by all. Some idea of the incentive for a personal test of the actual cost of carrying grain, etc., on the canal may be derived from the following from the Utica *Herald:*

"It is as yet an undetermined question whether the railroads can continue to carry grain at the rates now prevailing. Undoubtedly they can carry much cheaper to day than they could five years ago. Undoubtedly the increase in the volume of their business enables them to make the same earnings at a lower charge. The question arises whether it would not be worth their while to transport the grain of the West for a few years at a figure such as would barely cover the actual cost, in the hope of thus finally *destroying the canal route*, and then make up for lost time by absorbing its business.

"For years past we have been convinced that this is the general purpose of the railroad corporations. It may be hidden beneath a nominal war among themselves; but let the war be ever so fierce, there is a common interest which is all the time being served."

Commenting on the above, Mr. Alonzo Richmond, formerly President of the Board of Trade of Buffalo, says:

"It must be confessed that there are many indications of a settled policy on the part of the railroads to accomplish this end. On West-bound freights, which consist principally of goods which naturally go by rail, managers of the trunk lines pull together with the utmost harmony, maintaining rates which are three or four times as high as those which are maintained on East-bound shipments, which have hitherto come forward largely during the season of navigation by canal.

"There is no question but that the railroad companies of this State have been using both political parties to accomplish their own selfish ends. By skillful manipulation a most worthy portion of our population, upon whom the public usually rely for resistance to the encroachments of the great corporations of the State, have been made to play directly into their (the corporations') hands. It is hardly to be supposed, however, that the people of the State of New York, when they realize what is being done, will tamely submit to the virtual confiscation of a large portion of their property, which, as has recently been shown by the New York Daily *Bulletin*, is fast being accomplished, and it remains to be seen whether they will allow the canals of the State, which have been the great arteries of commerce, and have materially aided in making New York the 'Empire State,' to be annihilated."

To a proper understanding of the question of the use of steam on the canals, it may be advisable to state that the Legislature of the State of New York, on the 28th of April, 1871, passed "An Act to foster and develop the internal commerce of the State, etc.", and a commission composed of Geo. B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, Geo. Geddes, Van R. Richmond, Willis S. Nelson, Geo. W. Chapman, William W. Wright, and John D. Foy, were appointed to "practically test and examine inventions, or any and all devices which might be submitted to them for propelling boats upon the canal by any other motor than animal power." The Hon. Horatio Seymour declining to serve, the Governor appointed Daniel Crouse, of Utica, to fill the vacancy.

The commission was organized by the election of Van R. Richmond, chairman. Henry A. Petrie, of Albany, was appointed secretary, and David M. Green, of Troy, "Civil and Mechanical Engineer," was appointed as engineer to aid the commission in making the examinations and tests provided for in the act.

In reading up the reports of the practical tests (!) submitted to the Legislature in 1872, 1873, and 1874, one is impressed with the enormous amount of "guess work" they contain, and we will digress a little to look at a few samples.

Take, for instance, the case of a boat fitted with a 12″×12″ cylinder: the report says "the average steam pressure was 68.9 lbs., revolutions of the screw 89.4 per minute; horse power 38.6!"

Some idea of the process by which these queer conclusions were reached may be obtained by quoting further from the reports:

"The data from which the former has been estimated, were determined by observ-

ations taken at intervals of fifteen minutes for the entire run of sixteen miles, and are therefore reliable, but in regard to the coal consumption I am not so certain. Having ascertained the weight of a bucket of coal, the engineer was requested to report the number of buckets expended, and the statement above is based on his report."

Again, take the case of another boat fitted with compound cylinders of 7″ and 12″ diameter respectively, and with a stroke of piston of 12″. The report goes on to state in reference to this practical test (!)

Steam, high pressure cylinder.74 pounds.
Steam, low-pressure cylinder..18.75 pounds.
Vacuum.....15 inches.
Revolutions per minute.....115
Cut-off in each cylinder..... ¾

With these data, an approximate estimate of the power is made thus:

Speed of pistons, feet per minute.... 230.
Area of high-pressure piston, square inch..... 38.48
Area of low-pressure piston, square inch..... 113.09
Mean pressure, per cent of initial.... 96.
Mean pressure on high-pressure piston, per square inch, pounds (72+14.7) 0.96=..... 83.23
Deduct back pressure (18.74+14.7).. 33.45
Mean effective pressure on high pressure piston, pounds per square inch..... 49.78
Mean pressure on low-pressure piston, pounds per square inch (18.75+14.7) 0.96=..... 32.11
Deduct back pressure, half atmosphere..... 7.35
Mean effective pressure on low-pressure piston, pounds per square inch..... 24.76
Total mean effective pressure on high-pressure piston, pounds (38.48× 49.78=..... ...1915.53
Total mean effective pressure on low-pressure piston, pounds 113.09× 24.76=.....2800.11

Therefore,

$$\text{H. P.} = \frac{(1915.53+2800.11)\times 230}{33{,}000} + 32.87$$

The only excuse the writer can offer for presenting these extracts is to compare guess work with the true data that may be obtained with the steam engine indicator.

The boats used by Mr. Seymour in his tests were two in number, and of the ordinary model as used on the Erie Canal. The steamer pushing its consort, the "Hathaway," ahead of it. The steamer "Emma" was fitted with a simple upright engine 12″ diameter, and 16″ stroke, plain slide valves, with adjustable cut-off, to be worked from the pilot-house.

The engine was condensing, and all water of condensation was returned to boiler as fast as made, by a small plunger pump worked from crosshead of air-pump. Propeller-wheel was of peculiar design. A hub 4 feet diameter had four blades, each 2 feet long bolted to it this made the diameter of the wheel 8 feet, with a pitch of 6 feet. The wheel was located astern.

The upright tubular boiler, of ample capacity, fitted with internal magazine, would hold 700 lbs. of coal. Magazine was charged from deck, where the coal bunkers were also conveniently located.

An artificial draft was produced by a blower, driven direct from crank-shaft. The general design of the entire plant was admirable, the only defect being in the proportion of its various parts.

The principal instruments used during the test were a steam engine indicator attached to the steam cylinder by short, direct connections. A pyrometer was placed in the base of the smoke-stack. A small platform scale from the Buffalo Scale Works, stood on deck alongside of the coal bunker; on this was weighed every pound of coal that went into the magazine, and every pound of ashes taken from the ash-pit at each change of watch. A revolution counter of new and unique design was furnished by Mr. Frank J. Burns, of Buffalo, and fitted to the reducing motion of the indicator. The steam and vacuum gauges were tested by the indicator and variation noted.

To the side of the forward boat a tachometer was secured by a convenient frame of angle iron, and its revolutions recorded on deck by electricity.

Everything being ready, the steamer "Emma" was loaded with 7,300 bushels of wheat, and her consort, the "R. Hathaway," was loaded with 7,800 bushels, so that the united cargoes was 15,100 bushels of wheat, or about 430 tons.

The start from Buffalo was made at 1.35 P. M., July 11th, 1879, but owing to detentions caused principally by low water in the canal the boats did not reach Pier 8, East River, until 8.40 P. M., July 21st.

The following extracts from the data obtained will show the amount and cost in fuel of the power exerted.

FROM BUFFALO TO ALBANY.

Distance.....352 miles.
Mean effective area of piston..111.42 inches.
Time from Buffalo to Albany.197.5 hours.
Average revolutions pr. minute 45.2.
Mean effective pressure at 45.2 revolutions..... 22 lbs.
Piston speed at 45.2 rev. p. m.120.5 ft.
Total coal burned.....12,950 lbs.
" ashes made..... 1,807 lbs.
Per cent. of ashes.....13.95.
Coal burned per hour.....65.5 lbs.
Average Indicated H. P..... 8.95.
Coal burned per Indicated H.P. 7.31 lbs.
Combustible per Indic'd H. P. 6.3 lbs.
Coal burned per mile.....36.79 lbs.
Average miles run per hour... 1.78.
Average boiler pressure.....67 lbs.

FROM ALBANY TO NEW YORK.

Distance.....143 miles.
Time..... 48.6 hours.
Average revolutions per min.. 59.2.
Mean effective pres. at 59.2 rev. 29 lbs.
Piston speed at 59.2 rev.....157.8 ft.
Total coal burned.....4,655 lbs.
" ashes made..... 655 lbs.
Per cent. of ashes.....14.07.
Coal burned per hour.....95.7 lbs.
Average Indicated H. P.....15.4.
Coal burned pr. indicated H.P. 6.2 lbs.
Combustible " " " 5.34.
Coal burned per mile.....32.55.
Average miles run per hour... 2.49.
Average boiler pressure.....65 lbs.

The cut-off was inoperative at less than ¾ stroke, a defect that was not discovered until too late to remedy it before starting on the trip. This, with other defects, caused a useless consumption of coal estimated at 3521 lbs. during the trip, but notwithstanding this it was demonstrated that, with an additional depth of one foot more water in the canal and some slight improvements at the locks, grain can be carried from Buffalo to New York at a price that will pay the owners of steam canal-boats, even at the present low rates of freight. All that is required is an engine and appurtenances specially designed for this service, and I have reason to believe that capitalists stand ready to build and equip a line of boats as soon as they learn that it can be made to pay.

That previous efforts to use steam on the canals have been only partly successful is, in a great measure, due to efforts having been made to inaugurate "rapid transit" on the canal. But experience demonstrates, that about three miles per hour through the current is the best paying speed.

In conclusion I will digress and give a sample of the comical incidents that came under the engineer's notice, and helped break the monotony of their labors.

They were out at the same time the "Tile Club" were on the canals on their annual pleasure excursion, a full account of which was being noticed in the local press, and these hard workers in the interests of commerce, were frequently mistaken for the jovial artists, with ludicrous results. The first salutation was about 11.30 P.M. the first day out. As they were passing a "horse boat" a female voice came out of the surrounding darkness with: "Jane, Jane, here git up here right away if you want to see something grand. Here goes high life on the canal."

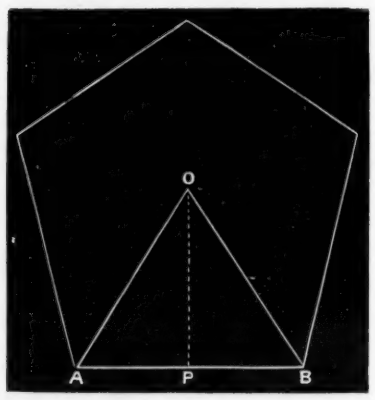
The "something grand" to be seen we took to be the four engineers out in the storm, wrapped in their rubber coats and huddled around the tachometer while an observation was being taken, and who were described a few minutes later by a profane mariner, as looking "like a lot of young roosters that had been in a swill barrel all night—" quite a difference of opinion truly; while as for the engineers themselves they were doubtless thinking of

"A life on the ocean wave."
The man that wrote it was green,
He had never been to sea,
A storm he had never seen."
[on the Erie Canal.]

Practical Draughting.—Study of Geometrical Figures.

BY T. P. PEMBERTON.

There is a language in drawing, and that is geometrical language. We speak of surfaces, lines, angles, triangles, squares, pentagons, hexagons, etc., and machinists, carpenters and builders, in common with all mechanics, perform their work on geometrical principles, and by means of geometrical figures. The mechanical engineer could not succeed without them; and to the military man, the navigator, and the civil engineer, they are the foundation of all their operations. In short, in every human pursuit, geometrical principles will be found. It will always be so. Man at best is but a copyist, for the beautiful in art is taken from the works of nature, as found in the animal, vegetable and mineral kingdoms. The *elliptical* green leaf, *hexagonal* cell of the bee, the *spherical* and *conical* forms of fruits and vegetables, and the *cubic* crystals of the mineral kingdom, are proofs that "God himself geometrizes," and we in our mechanical, agricultural, and domestic pursuits, are ever striving for and copying all that is beautiful and geometrically correct.



The importance of a knowledge of geometrical drawing at the commencement of a study of a drawing is paramount; as well might a student in music expect to become a player of Bach's fugues, or Handel's oratorios, without learning the rudiments of that science, as a draughtsman to become expert in his art without a knowledge of practical geometry. Says Walter Smith, State Director of Art Education in Massachusetts, "I have never known a case where a student did not progress more satisfactorily in his studies after a course of practical geometry." It would be superfluous, however, to introduce a description of the numerous geometrical figures here. What references we now make to them will only show students that before they can understand and *apply* them to construction drawings properly must get posted from the elementary works on the subject. The student will find that the figures enumerated below constantly occur in mechanical and architectural drawings, as, for instance, in the case of square and oblong plates, slabs, panels, hexagonal nuts and bolt-heads, octagonal boxes, shafts, columns, etc.; these can all be drawn geometrically in a quick and accurate manner. In the delineation of hexagonal and octagonal figures, the two set-squares or draughtsman's triangles already described, become useful, since their angles are the suitable ones for those figures.

The following table gives the circumferential and central angles of ten regular polygons:

Name of Polygon.	No. of Sides.	Polygon Angle.	Central Angle.
Triangle.....	3	60°	120°
Square.....	4	90°	90°
Pentagon.....	5	108°	72°
Hexagon.....	6	120°	60°
Heptagon.....	7	128° 17′	51° 43′
Octagon.....	8	135°	45°
Nonagon.....	9	140°	40°
Decagon.....	10	144°	36°
Undecagon.....	11	147° 47′	32° 13′
Dodecagon.....	12	150°	30°

In the annexed figure, the angles at O and B are the central and polygon angles.

Name.	No. of Sides.	Angle O B P.
Trigon.....	3	30°
Tetragon.....	4	45°
Pentagon.....	5	54°
Hexagon.....	6	60°
Heptagon.....	7	64° 2–7
Octagon.....	8	67° 1–2
Nonagon.....	9	70°
Decagon.....	10	72°
Undecagon.....	11	73° 7–11
Dodecagon.....	12	75°

The measure of an angle is an arc of any circle contained between the two lines which form that angle, the angular point being the center; and it is estimated by the number of degrees contained in that arc.

We have already alluded to sketching, and drawing on the blackboards as among the best elementary exercises for students. Next in order we commend the exercise of describing regular polygons, the study of decimal fractions, and mensuration. We repeat; to give descriptions and explanations of studies in these branches here would be only to re-write what has been and is being repeatedly published in school arithmetics, and in nearly all engineers and mechanics' guides and hand-books, but we wish to impresss upon the student that the sooner he supplies himself with some of these valuable aids and makes himself master of the contents, the sooner and better he will be enabled to draw quickly and satisfactorily to himself and others.

At the recent stockholders' meeting of the Manufacturers' and Mechanics' Institute, Boston, announcement was made that the entire capital stock of the association had been subscribed for. The Treasurer, Mr. John F. Wood, stated furthermore, that the large balance of the stock which had been placed within the past few days would be distributed among new members.

The list of officers elected is an additional assurance of the success of the enterprise. The full list of officers is now as follows:

President.—James L. Little, of James L. Little & Co., selling agents of the Pacific Mills.

Vice-Presidents.—Hon. E. R. Mudge, of E. R. Mudge, Sawyer & Co, dry goods commission dealers; William B. Merrill, of the Downer Kerosene Oil Company; C. A. Grinnell, of J. F. Dane, Grinnell & Co., boot and shoe manufacturers.

Executive Committee.—James L. Little; E. R. Mudge; William B. Merrill; C. A. Grinnell; John F. Wood, of the Union Stone Company; R. M. Pulsifer, of the Boston *Herald;* James H. Work, of the Providence Tool Company; Frederick W. Griffin; Thomas Boyd; Henry Mason, of the Mason & Hamlin Organ Company; George L. Damon, of the American Steam Safe Company; Louis Prang, of L. Prang & Co., art publishers; Edward Kendall, of Kendall & Roberts, steam engine and boiler builders; Royal C. Graves, of the Millers Falls Company, iron founders; and Freeman A. Walker, of F. A. Walker & Co.

The lot of land on which the institute will erect a building in which to show the products of New England arts and industries is located on Huntington Avenue, contains total area of about 260,000 feet. It is located within a few hundred feet of a side track of the Providence Railroad from which a spur could be run directly into the interior of the Exposition Building.

At the recent meeting of the Executive Committee, a sub-committee was appointed to take final action in regard to the site for an exhibition building, and the property on Huntington Avenue will probably be secured on favorable terms. The Institute will doubtless be ready next year to hold its first Industrial Exposition.

A Valuable New Compound Metal.

Mr. Spence, an Englishman, has invented a compound metal, which, if it possesses the properties claimed for it in the paper read a short time since before the British Society of Arts, promises to be brought largely into industrial uses as more applicable to many purposes than the metals now employed therein. This new metal is composed of the sulphides of iron, lead and zinc, which, when melted together in certain proportions, form a homogeneous mass. It is said to possess great tenacity, and not to be subject to oxidization either by the action of air, water or the alkalies. Even the most powerful acids act upon it very slowly, and only when reduced to a fine powder. The melting point of the metal is as low as 310, which gives it, we are told, a remarkable fitness for fine castings, especially such as are required for printing and stereotype purposes. In art work of a higher kind, as in statuettes and ornamental designs reproduced by moulding, the superiority is claimed for it that it is susceptible of the highest polish, and that it will take any color, from the dark blue of steel to that of bronze, silver or gold. Its cost, moreover, being but about one-fourth the price of lead, and its perfect freedom from oxidization will render it, in the opinion of the inventor and of the Society of Arts, of peculiar value for water pipes and cisterns, and in the manufacture of acids. It will be known commercially as "Spence's metal."

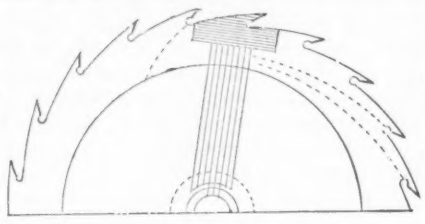
A Peculiar Chipping Chisel.

The cut here shown is a sketch of the wrong-appearing chipping chisel used in Tangye's concern in Birmingham, England, which was referred to by Chordal in last week's issue. It is a handle with a removable bit set into it. We reprint what Chordal said about it, hoping that some of our readers who have had experience will send some further information about peculiar chipping chisels.

The tool looks as wrong as anything I ever saw, but it is safe to say the Tangyes use good chisels. If any of the AMERICAN MACHINIST readers know anything about these tools they ought to speak up. If they are good tools to chip with, there is no question about their advantages. A set of three handles with about a handful of different sized and shaped bits will give a kit of chisels which few visemen in this country ever get hold of. The bits, being small, can be of the finest steel, something which cannot be afforded by the ton. A stock of dressed bits will save lots of running to the tool-dresser. Here's where some economy comes in. The convenience of the thing suggests itself. The Tangyes use one holder for wide flat chisels, one for narrow flats, and one for diamonds, copes, coltsfoots, round punches, sides, drifts, etc.

A railroad man, accused of drinking lager beer while on duty, calmly assured the superintendent that he was the victim of color blindness, and supposed that he was drinking water.

The project to form a co-operative building association is meeting with considerable encouragement in Fall River. At a recent meeting, the initiatory steps were taken. It was decided to call the organization "The Troy Co-operative Savings Fund and Loan Association." Thirty-four signed as members, and a charter is to be applied for. Each member will pay a fee of $1 per month of each share of $200 each, and no member is allowed to take more than twenty-five shares. The total number of shares is limited to 5,000. A similar organization is contemplated at Holyoke, where some fifty or more men are said to be interested in the formation of a builders' association to be conducted on the plan of Philadelphia's associations.—*Boston Commercial Bulletin.*



Forming Circular Saw Teeth.

Cut a sheet zinc or other thin metal template, and fasten to the end of a wooden strip which saddles the collar. The backs of the teeth should be circular ones struck from center, on the small circle The faces are tangents to the larger circle shown.

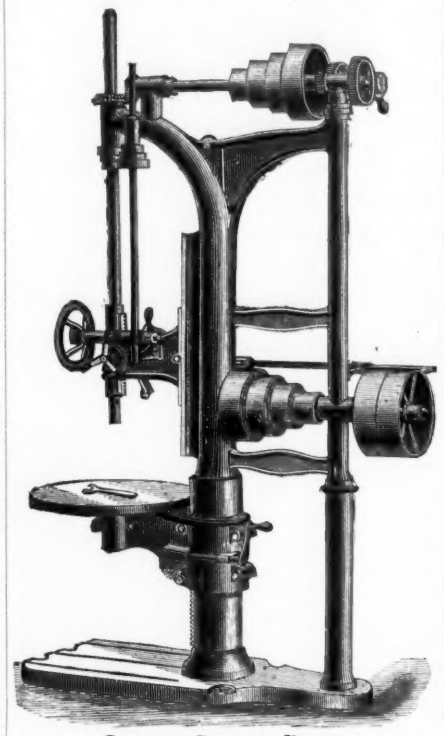
This rule for teeth forming is simple and the method of applying it equally so.

One of the most serious obstacles to the success of well-conducted business enterprises, which pay creditors one hundred cents on the dollar, is the frequency with which railroad and manufacturing corporations, carrying on the same kind of business, suspend and leave their creditors to secure such a percentage of their claims as the available assets can be made to pay. The officers and managers of these venturesome companies generally have their personal matters so fixed that they can lose very little by a failure or suspension of the concerns they control. This much assured, they conduct business on the "high and mighty" plan, and if successful, reap large rewards, but if unsuccessful, generally manage to excuse themselves from any blame. When a small concern fails, its business is usually closed up and the establishment wiped out of existence, but when a large corporation fails the business is likely to go right on under the management of the same individuals with a clean set of books. It requires a great deal of tact and energy for an always reliable business concern to compete with those conducted on this reckless plan. If a law could be enacted to protect those scrupulously exact about discharging their obligations from the unfair competition of the opposite class, it would be one of the strongest supports to every legitimate business.

The Victor Track Drill.

The accompanying illustration represents a very convenient and durable drill for the use of trackmen in drilling holes through the web of rails for the application of fish plates. It has a top fastener or clamp, which may be attached to the top of any size or form of rail, and is securely held in position by means of a wedge as shown. The drill is made of square steel, and may be fed forward by a suitable screw. The weight of the drill is twenty-three pounds, and is said to work very rapidly and easily. Rails may be drilled without being moved from their position. This drill may be instantly applied or detached, and is not liable to get out of order. It is manufactured by D. Saunders' Sons, Yonkers, N. Y.

The steamer Columbia, which is to run between San Francisco and Portland, Oregon, is in many respects a remarkable boat. The outside appearance of the steamship is little different from the ordinary iron, two-masted ocean steamer. Inside, however, it is fitted up regardless of expense. All the rooms are supplied with air driven in by an engine, and controlled by the occupant of the room. The air is hot in winter and cold in summer. The greatest improvement is the introduction of the Edison electric light in every state room, and, in fact, in every part of the ship. Four of Edison's dynamo machines in the engine room supply these lights. The lights in the state rooms are under the control of the steward outside. A globe of ground glass is attached to the ceiling, and fills the room with a clear, mellow white light that does not vitiate the atmosphere as a lamp or gas would do. A large headlight is placed in front of the steamer, that, lit by electricity, makes the water for a long distance ahead as light as day. All state rooms are furnished with electric calls, and the smoking room, etc., are connected with the officers' room by telephones. An electric tell-tale on the bridge enables the captain to note in what direction and at what speed the engines are running. The beds in the state rooms are made on the principle of those in Pullman cars, and can be folded out of the way in the daytime. Water is furnished by the Holly system of supply. A still keeps a constant amount of fresh water on hand. The Columbia is 334 feet long, and 3,200 tons measurement. All the stuffing boxes, fifty in number, are packed with Katzenstein's metallic packing.



DOUBLE COLUMN DRILL.

Double Column Upright Drill.

Most upright drill presses are supported from the base by nothing more than the main column. Unless this is very rigid and strong, it is difficult to keep a heavy piece of work perfectly steady while being drilled. Unsteadiness often causes a breaking of drills and inaccuracy of work. The Pratt & Whitney Co., of Hartford, Conn., have for many months constructed their upright drills with double columns connected to one base, which give the machines desirable stiffness under heavy work. The illustration on this page represents one of their improved machines. It has adjustable heads counterbalanced with quick return motion, an automatic feed, and Parkhurst's patent index for gauging the depth of hole to be drilled. Several sizes are made with tables from 24 inches to 42 inches diameter. The No. 2 machine has a spindle 1⅝ inches diameter; reach from column, 13 inches; tight and loose pulleys, 12 inches by 3 inches; table 24 inches diameter, and greatest distance from spindle to base-plate, 4 feet 3 inches.

VICTOR TRACK DRILL.

LITERARY NOTES.

THE IRON AND STEEL WORKS OF THE UNITED STATES, 1880. Embracing the blast furnaces, rolling mills, steel works, forges and bloomaries in every State and Territory, octavo. Price $3.00. Published by the American Iron and Steel Association, Philadelphia, Pa.

The above-named directory, published by the American Iron and Steel Association, has been well known and appreciated among persons who are interested in iron and steel. This book is similar in appearance to the former edition, but larger, having 184 printed pages. The contents have been thoroughly revised by Mr. J. M. Swank, secretary of the association, and reflects much to his credit, it being an exceedingly difficult task to compile the information required. This directory forms the fifth edition of the work and embraces all the new firms and companies lately organized. Since the issue of the fourth edition, there has been a great tendency to substitute iron for steel, and to increase the production of individual blast furnaces, and is rapidly growing. Owing to the rapid changes which have taken place in the steel industries it has been impossible to avoid some omissions, but these we are glad to notice are few, and it is as correct and reliable as possible under the circumstances. It contains the number and location of blast furnaces in the United States at the beginning of this year, also those in course of construction, capacity and kind of fuel used, also number of steel works, bloomaries, rolling mills and rail mills, which is a new feature. These, together with all the new processes, are classified so as to be readily accessible for reference. This directory will be found a valuable addition to the information already published in connection with the iron and steel industries of the United States, and we cordially commend it to our readers.

A co-operative boot and shoe manufacturing establishment at North Middleboro is talked of.

Summer Poetry.

Several of the newspaper poets have recently been hailing the advent of summer in a series of rhymed odes, of which each contributes a stanza. Not to be entirely outdone in this important province of journalism, we take note of an explosion which occurred in Syracuse the other day, in contributing our quota:

Now the deadly soda fountain
Bursts, and scatters mingled flavors
On the clothes of thirsty parents,
Drinking with their little shavers.

It is a matter for regret that Mr. Edison, however sincerely or naturally it may have come about, should have been beguiled into allowing a patent medicine to be issued as his invention, or as prepared under his directions. He has performed so much creditable work in scientific and mechanical discovery, and has it in him to perform so much more, that his admirers and friends should not be required to contend against suspicions or insinuations arising from such causes. Regarding the electric light, what is needed now is something in the line of tangible results, and such results cannot come a day too soon.

An Italian engineer has invented a steam bicycle; the boiler and machinery are directly under the seat of the rider.

Reports from the Millers' International Exhibition, now in progress at Cincinnati, indicate that it is gratifying success. The attendance is good and the displays of milling appliances good. Much interest is felt in the tests of steam engines.

From an analysis of the drinking water supplied to the people of Grand Rapids, Mich., submitted to the Sanitary Association of that city, it appears that the water is too thick for drink and too thin for food.

New Artesian Well Pumping Engine.

The constantly increasing demand for water in New York city especially, and the inadequate, as well as expensive, supply of Croton, have rendered it not only desirable, but also necessary for large consumers, to procure a supply from other sources. Where large quantities of water are used, as in breweries and factories, the city authorities have placed water meters, in order that the quantity of water used may be known exactly and the supply limited. A few years since, it was discovered that an excellent supply of good water might be obtained by sinking artesian wells from 700 feet to 1000 feet deep. It is quite recently, however, that the true value of the artesian well system has been definitely made known. The lack of successful and economical machinery, and the indefinite expense of sinking these wells, were serious obstacles in the progress of this new enterprise.

By means of the improvements recently made, artesian wells may now be put down at a moderate and easily ascertained figure. We illustrate by the accompanying engraving, an engine of new and efficient design, which is now being built by the Deane Steam Pump Company at Holyoke, Mass., warehouse at 92 and 94 Liberty street, New York, John H. Harris, Manager. This engine is designed to be placed directly over the well. It consists of a strong bed, to which is attached an upright column. The top of this column is turned, so as to form a pivot, upon which to hang the cylinder The steam and exhaust pipes are attached to the center of the pivot, and the connections are made to the cylinder by means of flexible joints, which are made tight by being provided with stuffing boxes. The advantage of this design is that, should any accident happen to the sucker rods or pump, it avoids the necessity of lifting the whole engine off the foundation, as is necessary with most of the engines now in use.

Should such an emergency occur with this engine, by simply removing a key in the crosshead and a taper pin through the pivot, the cylinder may be swung to one side in one minute's time. This leaves the rod and top of the well entirely free, without disconnecting any pipes. The cylinder may be instantly replaced and held in line with the pump, by means of the tapered pin passing through the pivot, as shown.

The crosshead is composed of two pieces, and is provided with two projections. These act in concert with two rubber springs, attached to the top of the well, thereby forming a cushion, and preventing damage to the parts, in case the piston should drop at any time. This engine is provided with three controlling valves, which contract or enlarge the ports, thus perfectly regulating the speed of the engine.

The valve motion is the same as that used on the other pumps manufactured by the company referred to. The different parts are easily accessible, and may be as readily detached and repaired, as on the ordinary horizontal pump. The passages for the steam and exhaust pipes are large, and the engine is said to perform its work in a very satisfactory manner.

STEEL MANUFACTURE IN CHINA.—A considerable steel-making industry exists in the present day in China, on the Upper Yangtza, whence the steel is sent to Tient-sin for shipment and distribution. It fetches much higher prices than the Swedish steel imported into the country. The Chinese metallurgists recognize three kinds of steel—viz., that which is produced by adding unwrought to wrought iron while the mass is subject to the action of fire; pure iron many times subjected to fire; and native steel, which is produced in the South-west. The different names for steel are Twan-Kang or ball steel, from its rounded form; Kwan-Kang or esprinkled steel; Wei-Tee or false steel. The Chinese apparently have known how to manufacture steel from the very earliest ages, and in the time of the Han dynasty ironmasters were appointed in several districts of the old Leanchon to superintend the ironworks.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * I wish for my special amusement you would send an artist out into the world with instructions to bring back a good woodcut of a common boiler front. By common I mean the kind one is most apt to see. I want to see a picture of an ordinary boiler front alongside the one you gave a view of on June 5, 1880. I know a lot of high-toned mechanics or engineers, or what not, who would take a fit if they should see that front.

These men have got it into their heads that every line and every pound of metal about anything made of iron should serve some useful purpose. These are the men who make the outside of a machine the same shape as the inside of the core boxes; the same men who speak of polish as a thing of utility only; the same men who paint things lead colored and call it steel color; men who never find out how to do work economically and find themselves compelled to leave all the nice things off in order to get the expensive product into the market.

* * * * This fancy boiler front is essentially a superior article. It is bound to be a better front than common. It is bound to save coal. Its very appearance shows that care, thought, skill, knowledge and time have been expended in its design. A design thus treated is bound to be based on good practical principles. If there is some peculiarly good point at which the grates should be set, I should look for a demonstration of the fact in a boiler front which looks as though it had been studied over. If there is a bad, warpy disposition in boiler fronts, this matured affair is apt to have been designed to avoid the defect.

* * * * Really nice things are seldom badly designed. It is in the coarser and more serviceable materials, purely "functional apparel," that we are apt to see misfits. Good looks tend to better everything around. There is no nobler use for iron than that of ornamentation, and like all good things ornamentation costs money. Beautifying a boiler front is just as reasonable and proper and elevating as beautifying a pier glass or a book case or a cornice. I have known of an artist being called on to design a paper collar for a chimney stack, which when done was a thing of beauty, and real honest human utility, and at the same time the base of that beautiful stack stood near a boiler front so infernally ugly that the furnace walls bulged out and staid bulged out. I can't imagine such a thing happening with a nice front.

* * * * The separation of beauty from utility in design has led to the entire separation of the arts, and now-a-days the designer is simply either an artist or, what is worse, an engineer. As a consequence, certain ugly things of real utility come from the engineer, and certain pretty things of no utility come from the artist.

I once negotiated at a good jewelry house, for a pair of sleeve buttons. They were elegant, but a little investigation showed that the stems were not long enough to admit two thicknesses of cuff; they were not worth five cents for the purpose intended. All the lines of these things had probably been fixed by some light-headed artist, who knew nothing of utility, and didn't want to mix it up in his occupation. He is as bad as the engineer or designer who leaves beauty out of his work.

* * * * Once upon a time I went into partnership with an artist. We had invented a draw handle or pull which possessed functions not necessary to explain. It was a question of design and patterns. There is no art about me, and I simply measured my own paw, and thus determined the proper length of the handle. This dimension, embodied in a sketch of the mere essentials of the device, constituted my contribution to the design. I turned it over to my artistic partner to put it into good form. He said at once that the thing was too big to look well, and wanted to contract it for beauty's sake, and he stuck to it too. We argued and fussed and quarreled over that miserable little drawer handle for a week and then quit. The thing was never made.

* * * * I was attracted by that boiler front because I have been brought up on ugly fronts of my own design. I have suffered much from having been educated in the "true utility" school, and when I get the ill effects of this education worn off it will be about my dying time. When I see pictures of old machinery I am glad I was born after the Corinthian Order of Architecture was abandoned in design, and when I look at my own work I am sorry I was born before dead work and lead-colored paint was abandoned.

* * * * A Philadelphia boy sent me a note the other day asking if I could give him any useful information about what books to read and some general plan of reading.

This is somewhat vague and unsatisfactory because he don't say what he wants to read about or how well read he is. Many mechanics who do read are called on for advice on such subjects very often, and as one of the common victims, I propose to unburden myself, and give some gray-headed advice on this subject, which is of more real importance to the ambitious young mechanic than any other matter. This is strong but true.

* * * * First and foremost, I notice that fairly or well educated young fellows don't want any advice on such subjects. Their minds are sufficiently trained to go it alone. When a youth leaves school at proper time, he ought to be educated thoroughly and perfectly. He may come out of school without any useful knowledge of any useful thing, but the imparting of knowledge is not the object of schools. Education develops the power to gain knowledge. An educated person can pick up general or special knowledge with readiness, but an uneducated one must grope his way, and educate himself as he goes along.

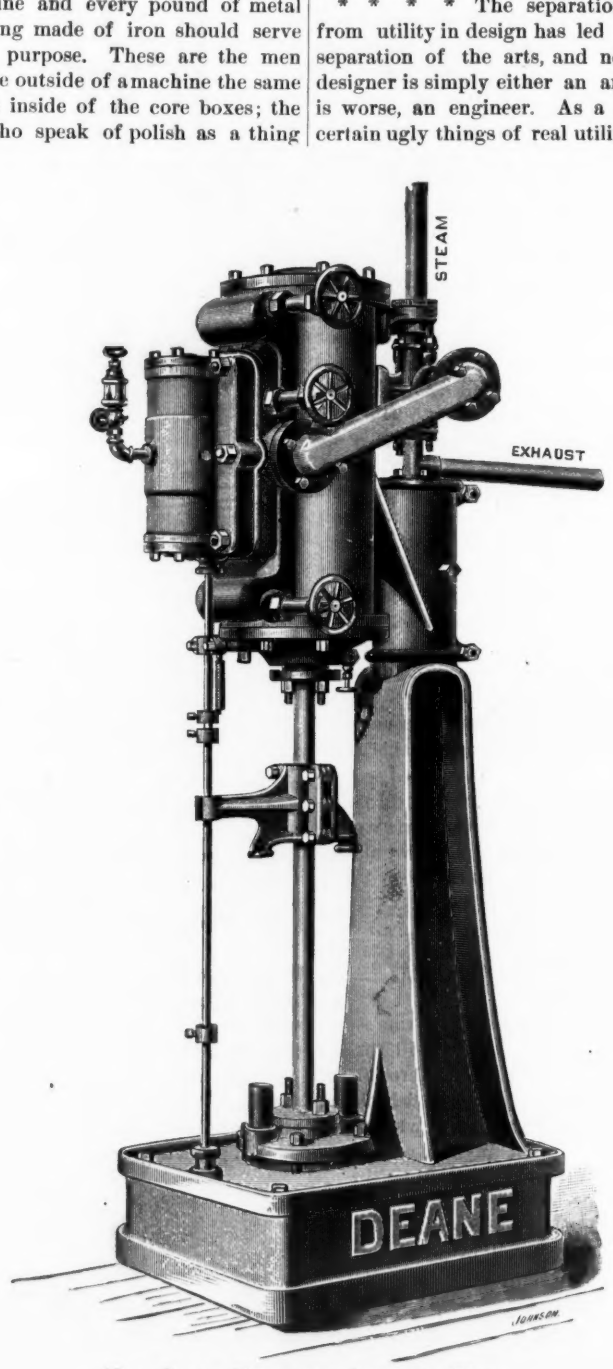
The young man just out of his time in a lawyer's office may be perfectly ignorant of law, etc., but it is well to remember what George III. said about his lord chief justice when he introduced him to somebody: "He don't know anything about law, but he knows how to find out."

The Philadelphia inquiry generally comes from chaps whose unwise parents put them in the shops at twelve or fourteen, when they ought to be in the fifth reader. The stuff that's in a fellow only shows itself when it's too late to start right. Ten to one he is not a reader. Ten to one he was brought up in a house without books in it. Ten to one he has never cultivated habits of knowledge-getting, and don't know how to get knowledge out of books. Ten to one the sudden studies he takes up are dry and laborious, and discouraging, and without any good results. Such are the kind who ask what books to read and how to read them.

* * * * To all such I would say: Here is a list of books and writers whose books you must let alone to start on.

Blackie and all others on drawing; Willis and all others on the principles of mechanics; Comstock and all others on philosophy; Campin and all others on practical mechanism; Ray and all others on mathematics; Macaulay and all others on history; Mill and all others on political economy. In short let alone severely every book which pretends to give you knowledge of any general or special art or science. If you find the word "practical," or "practically considered" about the title page, let it alone still more severely. These books are books of knowledge, while just now you want books of education. You want to cultivate habits of reading and you can't do it on this useful material.

* * * * Now for the books to read: First and foremost, take Cooper's novels, narratives of men and the sea. Then take Charles Reade's novels and drop them when you get tired of them, which will probably



NEW STEAM PUMP FOR ARTESIAN WELL.

be when you have read them all. Now you will find that you have read a lot of books and like the business. Now go for Irving's history of Grenada and find out how much real pleasure can be got out of the acquisition of knowledge of things you care nothing about. Then read Irving's Life of Mahomet, and acquire more knowledge, useless in the having, but pleasant in the getting. Once in a while study arithmetic out of Haswell, till you can feel at home anywhere in the book. Use a Webster's unabridged dictionary, just

details, but gradually learn to absorb the gist of a sentence at a glance. This is very important, for one must learn to get knowledge out of books without reading the book. If this kind of business is pleasant, it will be kept up, and if it isn't pleasant, it will be dropped, and that's all there is of it. If it proves pleasant, it will make a reader and thinker out of any person fitted for such work, and if a person is not fitted for it, he will not waste any great amount of time or money at it. One who thus finds himself in new

The working capacity of the machinery will be equal to five hundred horse power, and will require one hundred and fifty men to attend to all the departments of the work.

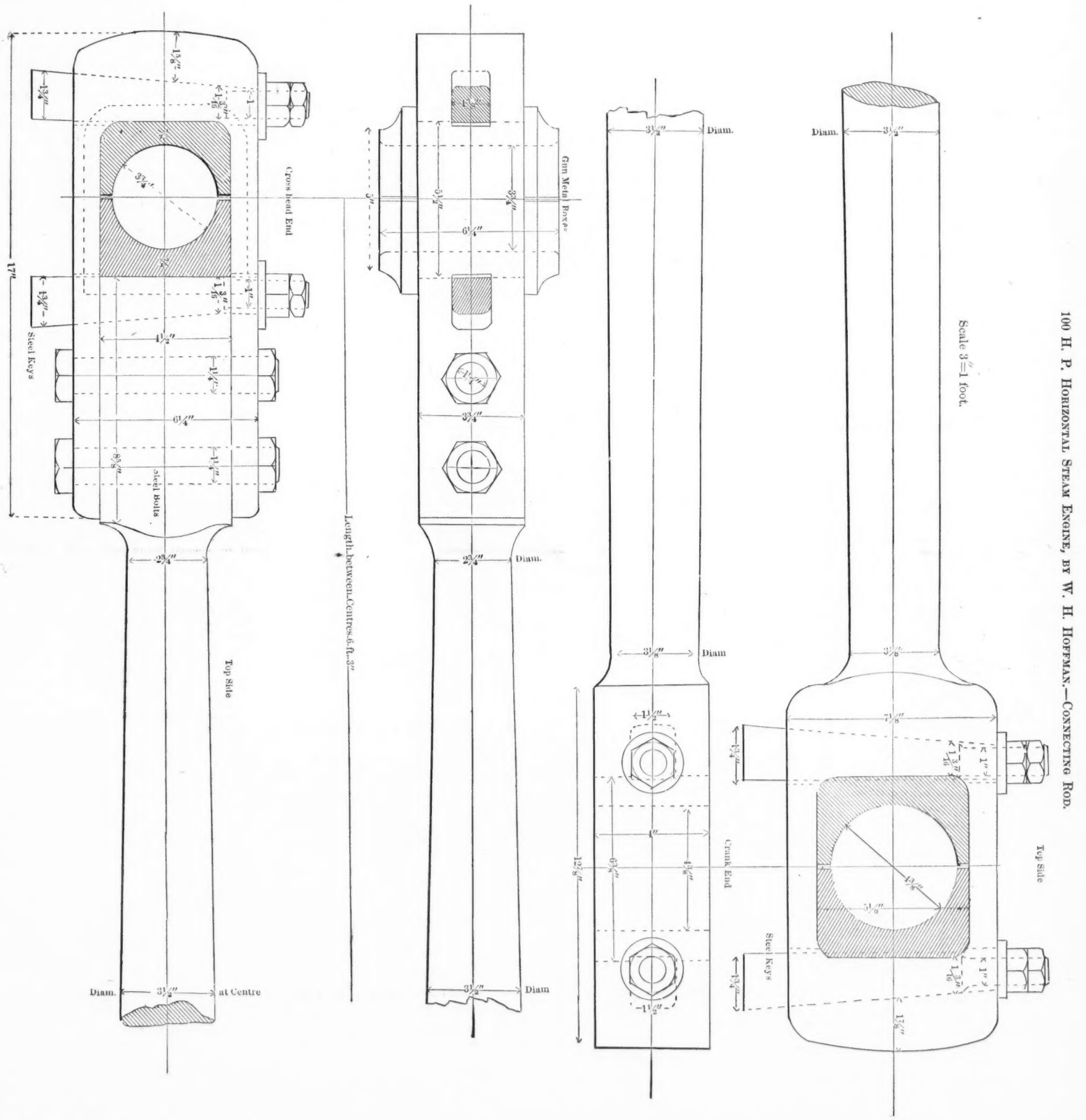
Working Drawings of a Steam Engine Connecting Rod.

On this page is shown a working drawing of connecting rod for a 100 horse-power horizontal steam engine: By W. H. Hoffman. This rod can be adjusted exactly to

are two keys used at each end, the movement for adjustment on each is very slight.

A more complete description of this rod has been already published in article on Engine Proportion and Construction, by Mr. Hoffman, which may be found in the AMERICAN MACHINIST for July 26 and August 2, 1879.

An interesting table has been prepared to show where England finds the customers for her goods. According to this table the an-



for the fun of looking at it, and after a while you will appeal to it to help you out on Haswell. Then invest twenty-five dollars in Chambers' Encyclopedia and amuse yourself with it. Refer to it when you want more information than Haswell or Webster gives. Don't study on things in Chambers' unless you want the information at once. Look to it to settle questions, etc. All this time read a daily paper every day. Don't read every word in the paper, but gradually learn to get everything out of it without reading every word. Don't read head lines for

fields and pleasant ones, will soon learn that the channels of information are all open and that the getting of knowledge is "doing work," and that the getting of education is "learning how to do the work simply and easily."

* * * Very respectfully,

CHORDAL.

A stock company is being organized in Geneva, Wis., to be known as the Geneva Grape Sugar company, for manufacturing of sugar. The capital stock is to be $300,000.

its original length at all times with perfect ease, while the security of detail of adjustment is beyond question. This rod also insures the least possible amount of piston clearance, which need be no more than $\frac{1}{16}$ of an inch in any cylinder. The engineer in charge of engine should have a gauge rod of iron the exact length of rod between centers when new, and this must be used whenever he takes up the slack, or wear of boxes. It will be observed that the body of this rod has very little taper, being made as light as possible at the center, and crank end. As there

nual consumption of her manufactures per head in different countries is represented by the following figures; United States, 7/; Germany, 9/2; France, 7/8; North American Colonies, £2 2/9; and Australia, £8 10/8. Australia actually consumes, in proportion to its population, a larger quantity of English manufactures than England herself. Perhaps if the figures were brought down to the most recent dates we should show a different record. Our late importations of iron, as well as other goods, we are sorry to say, look like it.—*Iron Age.*

The Dephosphorization of Iron in the Bessemer Converter.

[Extracts from a paper read at the meeting of the British Iron and Steel Institute. By Mr. R. PINK, HOERDE, WESTPHALIA.]

It will be remembered that in April of last year, and again during the May meeting of this Institute, it was demonstrated that the problem of dephosphorizing iron in the Bessemer converter had, by the Thomas and Gilchrist system, been definitely solved at the Works of Messrs. Bolekow, Vaughan & Co. The Hoerde Company, who had representatives at Middlesbrough and Eston during these experiments, at once determined also to test the process. It was then thought their plant was such as would make it comparatively easy for them to do this. They had a small plant of two three-ton converters and a larger one of three eight-ton vessels.

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The manufacture of good gray foundry pig at Hoerde is always so costly that the margin of difference between it and Bessemer pig is too small to allow of this class of iron being used alone, and, considering the question entirely as one of dephosphorizing, it was determined to use poorer brands of white forge half-mine pig. In the use of this class of iron a claim may be laid to the progress before mentioned, and what has been done confirms both the possibility and the probability of yet greater achievements in this direction. Without doubt we are on the verge of making, from the very worst classes of pig iron, a most reliable and remarkably cheap steel.

In Hoerde attention has not been paid to producing a better quality than that now in the market, but to making the same quality out of such irons as have just been mentioned. As good reliable rails are made by the regular process with .08 per cent. of phosphorus in them, rails are made by the new process with .07 per cent. or .06 per cent., these being considered equal to all the requirements of railway material. For axles, tires, plates, and wire billets, the phosphorus is reduced to a much lower figure than this.

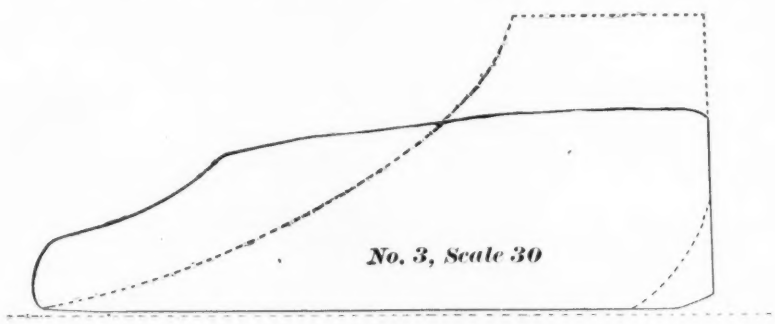
On the 22d of last September Hoerde got, after great delay in looking for the best class of kiln to burn the bricks and dolomite in, one three-ton converter at work, and at the same date rolled direct from the ingot the first rail manufactured under the Thomas patent in Germany. This rail stood exceedingly well under the tup, in spite of the phosphorus showing .12 per cent., but by the third charge the phosphorus was reduced to .06 per cent., and from this period, with one exception, no difficulty has been found in keeping the phosphorus within the limits of .08 to .04 per cent.

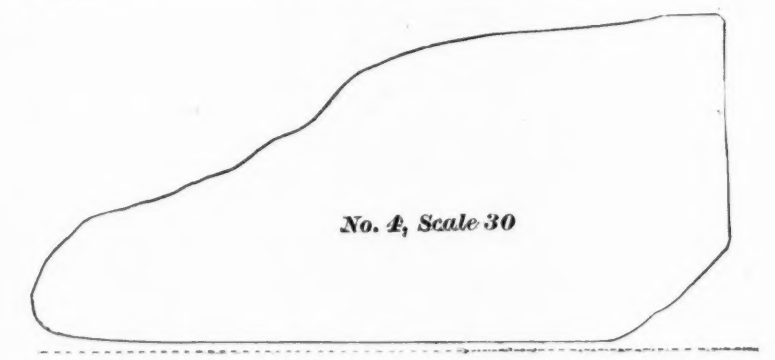
At first, copying the example of Middlesbrough, iron was used containing as much as 1.5 per cent. of silicon, and it was determined to reduce this body at least one-half. That it is possible to do so without detriment to the charge was soon apparent, as white forge pig containing but .73 per cent. of silicon was melted with 20 per cent. of steel scrap in the cupola without the metal boiling over in the converter in a sensibly higher degree than usual, while it allowed the ingots to be cast ascensionally. Guided by these results, silicon has always been kept low, and, as a consequence, white forge pig can be used instead of the much more costly foundry Nos. I. and II.

In order to increase the fluidity of this class of metal, and if possible to add an increment of heat, it was resolved to make a forge pig containing at least 1 per cent. of manganese, and, although the expectations entertained of thereby fluxing the basic additions at an earlier period in the charge have not been fully realized, this body doubtless does act as desired in the first two cases, and assists also in removing the sulphur that may be contained in the metallic bath. Manganese may be termed the key to the use of cinder pig, where it can be cheaply and in sufficient quantities introduced into the iron in the blast furnace, or later in the Bessemer converter.

With the object of getting still greater heat on the metal, iron with larger percentages of phosphorus has been used, and the great value of this is clearly demonstrated; for, when two per cent. of this metalloid is contained in the charge to be converted, groups of eight ten-inch ingots can be cast ascensionally with perfect ease, the steel being so quiet in the moulds as to allow of its being stoppered with light iron stoppers instead of with the troublesome and dirty sand-stopping.

Of course the quantity of basic additions has to be increased, but not in so great a ratio as to be excessively expensive, or to cause trouble in the converter. Never less than fifteen per cent. of good burned lime is used, be the amount of phosphorus what it may; and when working irons with upwards of two per cent. of phosphorus, twenty per cent. of lime is found quite sufficient. In the first case the lime is badly fluxed, and in the second the slag is very fluid. The fluxing of the lime has been attributed by many to the excessive waste of iron during the overflow, the oxides of which were supposed to reduce the slag to this state of fluidity, but on looking at the subjoined analyses it will be found that the waste of iron is not excessive. To produce sound homogeneous ingots, a good percentage of phosphorus—





say between one and two per cent., or even in excess of this latter figure—appears to be indispensable, and irons containing so low a percentage as .5 do not appear suitable, unless this body is introduced in the charge by one or other of the known means, the best of which appears to be the use of ferro-phosphorus. That phosphorus can and does replace silicon as a source of heat in the Bessemer converter, when working on the Thomas-Gilchrist system, is no longer to be disputed.

The method of carrying out the process at Hoerde is as follows: After heating up the converter, and without tipping out the coke used in so doing, the lime, mixed with a little small coal, is added, and, after blowing through for a few minutes, the metal is run in. In the three-ton converters, the time occupied in blowing a charge of from three tons ten cwts. to four tons, up to the vanishing point of the carbon lines of the spectrum, varies from nine to thirteen minutes, and the afterblow to 115 to 300 seconds. A test-piece is taken shortly before the charge is considered as finished; this, when forged, is cooled in water and then broken, after which the blowing is continued as considered necessary. A second test-piece is now rarely taken, as the first is so timed that a further half or three-quarter burn-up of the converter suffices to finish the charge. The slag is then run off and the spiegeleisen added. This running off of the slag prevents, in a great measure, the reduction of phosphorus out of the same by means of the fluid addition.

Good sound burnt lime, broken up to about the size of hens' eggs, and used as fresh as possible after burning, has been found to be the best basic addition, and could this be introduced cheaply and expeditiously in a white or red-hot state into the converters, it would prove of great advantage. The lining of the converters will be better protected during the oxidation of the silicon, and a fluid slag earlier formed by this means.

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In the testing machine the following results were obtained:

Steel from charge No. 67 showed a tensile strength of 50.1 kilogrammes per square millimeter of section (say 72,000 lbs. per square inch), with an extension of 20.6 per cent., and a contraction of area at point of breakage of 44.8 per cent.

Steel from charge No. 68 showed a tensile strength of 53.5 kilogrammes per square millimeter of section, with an extension of 22 per cent., and contraction of area at point of breakage of 47 per cent.

Steel from charge No. 69 gave a tensile strength of 54.3 kilogrammes per square millimeter of section, with an extension of 19 per cent., and contraction of area at point of breakage of 42 per cent.

All the test-pieces had a length of 150 millimeters, and a diameter of 15 millimeters.

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The results of the three charges, No. 67 68 and 69, show that without great loss of iron the silicon can be kept low, and by having manganese in the bath a great deal of the sulphur is also removed. These facts point to the wished-for end, namely the use of a cheap cinder pig. These charges only show a loss of 10.7 per cent., but the average loss at present comes up to about 17 per cent. When pit scrap, skulls, &c., are weighed in, this amount is reduced to something like 15 per cent.

A point of some importance in connection with this process is the blocking up of the converter with slag, and in cases where proper provision against this has not been or cannot be made, it proves the source of much delay. To provide against such a defect, many methods of fluxing the basic additions at an early period of the process have been tried, with but negative success. At Hoerde, however, a system has been used that is very promising; and when a proper isolating medium for separating the acid from the base is used, there is no doubt that blocking-up will be greatly reduced, if not entirely got rid of. The system referred to is the building in of good fireclay bricks on the points where the slag adheres principally on the back of the throat, and along the slag-line of the converter when in its teeming position. At first only 12 in. down the throat were so lined, but behind this the block up was as great as usual. This zone was then deepened to 4 feet in a converter of 13 feet, and the nose kept perfectly clean where the fire-bricks were built in; still the slag blocked up directly below this zone. This is, however, of small importance, and, indeed, tends to keep the iron from boiling over, while its position in no way interferes with the regular working of the converter.

This blocking up of the converter appears not to be thoroughly understood; for, whereas the Rhenish Steel Company have no cause of complaint with their six-ton converters, and Hoerde no difficulty with the three-ton ones, the eight-ton vessel of the latter firm causes a good deal of trouble. No difficulty has been found in eliminating the phosphorus, even when such large patches of fire-brick have been used as are here referred to.

The small converters can be much more rapidly manipulated than the larger ones, and the delay in taking the tests is not half so great. Delay is the cause of more blocking-up than anything else. To avoid this, there appears, as the very best remedy, exceedingly rapid manipulation of the whole plant, and the reduction of the necessity of taking many, or any, tests during the charge. When working with a perfectly-known quantity of phosphorus and silicon, the former can be reduced to 0.07 or 0.08 without even once testing. Again, when the bottoms do not stand, the blocking-up is very bad. This is no doubt caused by the insufficient fluxing of the dolomite loosed from the bottom. The slag, being then thicker, adheres more easily. In all cases, the heat of the charges has been greater and the blocking up less when using the highest obtainable blast-pressure.

Great speed in working, together with large ladles that allow of rapid teeming, combined with a sufficiency of phosphorus and manganese, as also good bottoms, with a minimum duration of ten charges, and the use of fire brick zones at the points most liable to incrustation, appear to be the solution of this inconvenience. Bottoms give trouble principally on account of their irregularity, giving at one time 16 charges, and then, again, only four or five. The undoubted cause of this is the insufficient calcination of the dolomite, which, when exposed to the influence of the atmosphere after being ground, or even when grinding, rapidly absorbs moisture. It must be admitted that if the causes of bad bottoms are as above stated, with more experience and care in preparing them they ought all to go up to the highest figure here given.

The average life of bottoms, either rammed round pins or clay tuyeres, is about nine charges, and with bricked ones better results have only been obtained occasionally.

Converter-linings last, including the necessary patching, from 90 to 130 charges. Patching consumes about 50 per cent. of the amount of bricks required when first lining up, so that a three-ton converter requires for, say, 120 charges, or a total production of 460 tons, as near as possible 4,500 basic bricks.

The irons now used at Hoerde are their own rejected foundry No. 3, foundry scrap, a half-mine forge pig, the white forge pig of Messrs. De Wendel, of Messrs. Metz of Luxemburg, and of the Ilsede Company in the province of Hanover. This latter contains as much as 3 per cent. of phosphorus and about 2-5 per cent. of manganese.

The three-ton plant produces about 40 tons daily, very nearly the same as when working these converters acid-lined. The shop is so cramped for room that rapid working is an impossibility.

In this department, tires, axles, plates and material for wire are solely manufactured. Upwards of 4,000 tires have already been turned out, and many hundreds of axles. Everything is cast ascensionally, the tire-ingots in groups of four, and the axles in groups of three double ingots, whilst for wire 8-inch parallel ingots in groups of four are cast. These latter weigh about 600 pounds, and are rolled down to $1\frac{1}{4}$ inch billets in one heat, on a 12 inch train.

The eight ton plant has, for want of sufficient basic material, and during the alterations now making, only one of the three converters working on the system. This has to take its turn with the others, and, from causes mentioned at the commencement of this communication, the production has not been so regular as that of its smaller neigh-

bor. Here only rail-ingots are cast in groups of 8 inch or 10 inch square. These are then rolled direct in one heat, without previous forging or cogging.

Doubts have been expressed as to the capability of producing hard steel by this process. Little experience has been gained in Hoerde in this direction, as nearly all orders are for comparatively soft material. The axle orders are specified as not under 50 kilogrammes of tensile strength per square millimeter of section, and a contraction at the point of breakage of not less than 35 per cent. For tires, the lowest tensile limit is 45 kilogrammes, and the least allowable contraction 35 per cent. However, the sum of the tensile strength plus the contraction must reach 90 per cent.

Such conditions can be fully met, and many test pieces show up to 63 kilogrammes with a contraction of 39 per cent. This is the general quality desired, and so no efforts have been made at producing harder steel.

In the softer qualities, for plates, wire, &c., it is at times astonishing what results are obtained. With 37 to 40 kilogrammes of actual breaking weight, as much as 70 per cent., and in some cases even 75 per cent., of contraction has been reached. At the same time, this ingot iron can take very high heats forging and rolling without a flaw. The production of this especial quality is so simple, the cheapness of the raw material, the certainty in working, its softness and ductility, all point to its driving at no very distant date puddled-iron plates out of the market. For wire even of the smallest gauges it has been declared better than that drawn from billets puddled from charcoal pig.

An interesting and practical proof of the quality has been demonstrated during the last few days. The fire-tube of a Cornish boiler at one of the mines in the neighborhood of Dortmund had to be removed on account of two of the plates bulging in. The water with which this boiler was fed contained such large quantities of common salt that an incrustation of several inches was formed in a very short space of time. Under these circumstances, the plates got red-hot and buckled in. They show no flaw, although the identations are in some cases 4 ft. long, from 6in. to 18in. wide, and 7in. or 8in. deep. These plates were manufactured at Hoerde, under the system of Messrs. Thomas and Gilchrist, in February of this year.

The character of plant that the Hoerde Company possess is ill suited to the requirements of this process, and Hoerde has had the disadvantage of being the experimental bureau for Germany. In order to get the full benefit that the process undoubtedly brings, special plant should be designed for it. Spacious shops, with good facilities for clearing the pits of ingots and slag boxes, are very desirable; possibly, also, the converters should be built up in sections, and, above all, plenty of blast and great speed in working. When a charge of 8 tons of white forge iron, containing up to 2 per cent. of phosphorus, is converted, including the after-blow, in 8 or 9 minutes, the metal will be at least as hot as that when gray silicious pig is used by the old method. In proof of this, a charge of white phosphoric pig was blown in the presence of Geheimrath, Dr. Wedding and Professor Finkener, and for the purpose of getting a correct diagram, the charge was turned down no less than eight times to take necessary tests. The actual time of blowing was under 9 minutes, and the steel ran ascensionally as well as could be wished-for without the least skull.

One of the 20 foot furnaces recently started at the Edgar Thompson steel works of Pittsburgh made over 1183 tons of Bessemer pig iron, the week ending Saturday, May 22d. This was done without using any scrap except that made by the furnace during the time, and is considered a marvelous record for a week's work.

Letters from Practical Men.

Editor American Machinist:

I ran across an idea in pulleys, a few days since, in a country saw mill, that struck me as being worthy of record, inasmuch as it was entirely home-made, a feature which, I believe, many of your readers will value.

The cheapest pulley to many persons is an ordinary wooden one, "built up" with wood arms, and fastened to the shaft by means of a cast iron flange (furnished with a set screw or key), bolted to center of the arms. This involves the services of the founder and machinist, not always convenient.

Fig. 1 is a side view of the "home-made" pulley. The rim *a,a*, is built up as usual, the half arms *b,b*, being "built in." The shaft-hole *c*, is worked out, half in each half arm, and slightly larger than shaft it is to fit. A piece of sand paper, rough side in, is wrapped round the shaft where the pulley will come, and the whole bolted up. A temporary rest serves for turning off the face of the pulley on the shaft, which is then ready for business. I saw a 36-inch pulley of this kind, ten-inch face, on a 2½ inch shaft, driving a 30 inch circular saw, by an eight-inch belt. This pulley had been doing this work for six years, I was informed, and as far as slipping on the shaft is concerned, the saw running into a knot checked, almost to a halt, a

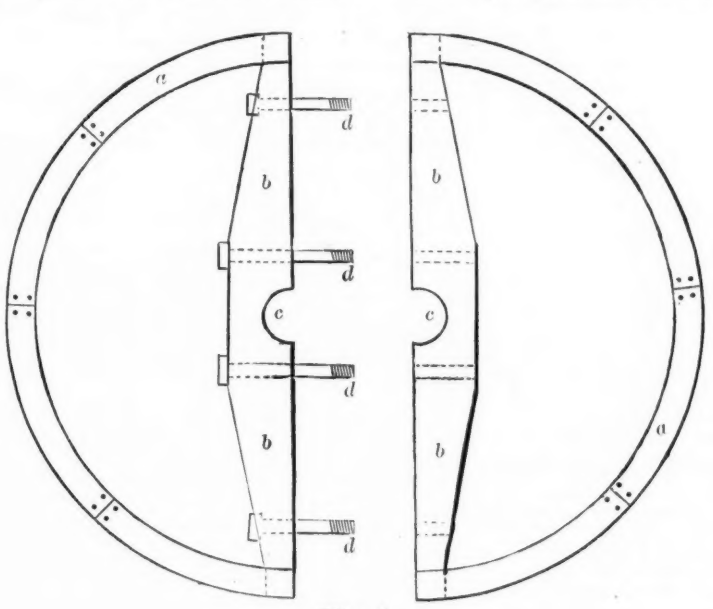

Fig. 1.

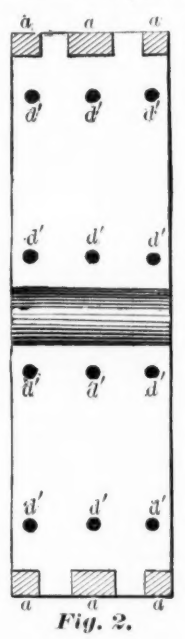

Fig. 2.

10×22 inch engine, the pulley failing to slip in the least. This pulley had a rim two inches in thickness, two arms, as shown, being sufficient to prevent any springing of the rim. Twelve bolts *d*, in Fig. 2, ¾ inch in diameter, were used. The mill owner thought the secret of the whole lay in the sand paper on the shaft, but the writer's experience is that solid oak arms, the shaft-hole a shade smaller than its shaft, and $\frac{1}{16}$ of an inch less in depth in the arm than the radius, so as to allow of the arms hugging the shaft when bolted up, will answer as well.

The pulleys being in halves are very convenient in putting up or taking down, and any carpenter can build them. In a country mill, where it is necessary to drive fifteen or twenty miles to a shop for cast iron flanges, or a cast pulley, this plan will be found acceptable. They can be used on a rough, as well as a turned shaft.

Yours, FRANK C. SMITH.

Delaware, O.

CAUSES OF POUNDING IN A STEAM ENGINE.

Editor American Machinist:

I inclose you two indicator cards, which I think will be instructive and interesting to your readers. The engine from which the cards were taken, although well constructed in other respects, had an inherent evil which caused "pounding." Card No. 3 shows the action of the steam and the cause of the evil—insufficient cushion. More lap was given to the valve outside, and the pounding ceased. Card No. 4 was taken after the change was made, and shows the increased cushion by outside lap. As card 4 is very fine, I think your readers might be interested to know the conditions under which it was taken. The most important are as follows:

Horizontal engine	11″×16″
Revolutions per minute	120
Length of steam ports	7.5″
Plain D slide valve	
Outside lap	1″
Inside lap	$\frac{1}{16}$″
Lead on crank end	$\frac{1}{8}$″
" " other end	$\frac{1}{16}$″
Travel of valve	3″

It will be seen that the full linear opening given the ports is .5″. giving an area of .5×7.5=3.75 square inches; speed of piston, 320 per minute, multiplied by area of piston in inches, 95=30,400, which divided by 3.75 =8,107, as the constant number used in this case. The card does not indicate that any wire drawing was caused by the valve until very nearly the point of cut-off. The exhaust is splendid, and but very little back pressure. The boiler is of the horizontal return tubular type, with a small steam dome over the bridge wall, from which steam is taken to the engine. The steam pipe is clothed with felt, and the cylinder is protected by a cast iron covering, between which and the cylinder there is an air space of about one inch. The expansion and compression curves show a fine quality of steam.

By a careful investigation of these cards, it will appear that plain side-valve engines having considerable clearance will admit of a closer cut off than when the clearance is small. Outside lap hastens the cut off, the exhaust opening and closing. Card 4 shows all these features over card 3. A better card yet would be made if the cut off occurred at half stroke and there was sufficient lap on the inside to retain the steam to the point of exhaust shown in card 4. The cushion would be considerably increased, but not sufficiently to exceed initial pressure (as there is a good deal of clearance in this particular case), and there would be no loss but a gain for every bit of it.

I would say for the benefit of any one who would like to make a cursory examination of the cards, that the atmospheric pressure may be taken at nine pounds per square inch, the engine being at an elevation of about 10,500 feet above the sea level. The clearance may be approximated by the compression curves as the steam was dry. Card No. 4 shows a performance of 35 I.H.P. per hour on 910 pounds of dry steam=26 pounds per I.H.P. per hour. The lightness of the atmosphere has a great deal to do with the above economy, as there is 5.7 pounds less pressure here than at sea level.

The cards were taken with a Thompson indicator, and the pipes used were ½″, and short motion was taken from a swinging arm attatched to the cross head, and care was taken to secure accuracy. They were taken from the crank end of the cylinder. And right here I should like to ask you, Mr. Editor, which is the forward and which the back end of an engine? I call the crank end the back end, for the reason that locomotive engines run cylinder first.

Respectfully,

Leadville, Col. ED. F. WILLIAMS.

STEAM TRACTION FOR FARM WORK.

Editor American Machinist:

Since the issue of No. 7, current volume of the AMERICAN MACHINIST, which contained an illustration of a farm engine, several letters have been received by me which call for a statement of some of the conditions which are indispensable to the successful working of the traction engine. The trial of such engines began many years ago, and they have been constructed in great diversity of form, and have been tried on every condition of road, so that they are no longer a subject of experiment.

It is now pretty well understood that the road must be hard and level to assure profitable success, unless the nature of the work is such as to furnish a road only one way, and *that* down grade, as often happens in mining, quarrying, and earthwork. The law of gravity is invincible, and that of mud and sand ditto, and every attempt to work the traction engine on common roads indiscriminately must, of course, result in utter failure, as far as profit is concerned. These machines may be made to perform wonderful feats by way of showing off their capabilities, but it will not prove wise or profitable to work them much, except on a hard level track. To draw a load up a grade of 80 feet to a mile requires about five times the effort that is required for a level track; such a grade is hardly perceptible, on the ground, to the eye. In a grade of eighty feet to the mile, the road is elevated one rod in advancing sixty-six rods, hence it requires a force or pull equal to $\frac{1}{8\frac{1}{8}}$ of the weight of the entire train, engine and all, in addition to the force or pull required for a level, to overcome the gravity of such a grade. This great difference in favor of a level track shows the importance of going five miles round a hill on a level road, rather than attempt to go half a mile over a hill even on a grade of eighty feet to the mile.

F. G. WOODWARD.

Worcester, Mass.

A correspondent of the *Scientific American* says, there is much need in Colorado of a portable steam drill for prospecting purposes. It should be so constructed that it could be packed on a mule or carried in parts by two men. Its weight should not exceed 150 pounds, and it should not cost over $200. The machine should be capable of drilling granite to a depth of fifty-feet, making a bore three-eighths to three-fourths inch in diameter. It is said a large market would be found for such a drill in Colorado for gold and silver prospecting.

With all the millions of sheep raised in New Mexico there is not a woolen mill in the territory; with cattle innumerable there is not a tannery; with millions of trees there is not a planing mill; with abundant natural products for making iron there is not a single foundry.

The Commission appointed by the Russian Ministries of Public Communications and of Finance, to investigate the condition of the iron industry of Russia, has recommended that agricultural and other machines from abroad hitherto imported free of customs duty shall henceforth pay a duty, and that the duties on those already liable shall be largely increased.

The stone foundation of the new Pennsylvania Railroad grain elevator at Jersey City cost, with the filling of the marshes around it, about $100,000. In the building there will be twenty-four sets of elevating apparatus for taking grain from cars.

A new iron foundry is projected at Bridgeton, N. J., a number of Philadelphia capitalists having, it is said, rented an old foundry property in the above town and propose to soon put it in running order, and employ quite a large number of hands.

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Activity in Building Machine Tools.

Among our manufacturing industries which have felt the exhilarating effects of the business boom none have shown more gratifying evidences of advancement than the machine-tool industry. In our issue of June 28th last we gave a list of forty-three establishments then engaged in the building of machine tools for the general market, and the names of a number of others who had gone out of the business within the past few years. We are glad to observe that some of the latter have started up again with good prospects of success while a few new establishments have entered this field of competition. One year ago the probabilities of all our machine tool manufacturers becoming pressed with orders for early delivery seemed very remote, yet to-day those wishing to purchase iron-working tools are in most cases obliged to wait for some weeks—in many cases for months—to obtain what they require. Some of the large machine tool works of Philadelphia, Worcester and other cities are so much crowded with work that they can scarcely take an order to be filled within three or four months. A few, we note, have recently advanced their prices for the second or third time in the face of a decline in iron and metals. It is to be hoped that they will not advance prices so rapidly as to bring on a reaction similar to that in iron. Some valuable improvements are being made in machine tools, although the general appearance of the machines changes but little. While there is likely to be less hurry to fill orders during the last half of the present year, indications point to a continued prosperous business in the manufacture of machine tools.

Civil Engineers' Convention.

The twelfth annual convention of the American Society of Civil Engineers which met in St. Louis, May 25th, was an interesting gathering. In the absence of the President, Mr. Jas. B. Eads was called to the chair, and Mr. Wm. P. Shinn, elected Vice-Chairman. The mayor of the city delivered a pleasant address of welcome, after which the Society attended to the reading and discussion of papers. Among the subjects treated were the Hudson River Tunnel, Peruvian Tunnels, Tensile Tests of Cements, American Cements and Waterproof Covering. The Annual Address, prepared by the Vice-President, Mr. O. Chanute, "On the Progress of Engineering in America," was read by the Secretary, Mr. John Bogart. Several excursions and other entertainments were enjoyed by the members of the Society, but it was impossible to accept all the invitations of the kind that were offered.

Substituting Dealers' for Makers' Brands.

As a result of the natural desire of customers to buy of manufacturers whenever possible, the practice of marking the dealer's name on taps, dies and shop tools generally, as the ostensible manufacturer, instead of that of the real manufacturer, is one which is open to grave abuses. The manufacturer who has a large part of his capital locked up in appliances for making and selling, if a wise man, has usually too much at stake to risk any deterioration in the quality of his work, under even the severest competition.

But the dealer, the natural tendency of whose business is toward shifting and change, whose interest in the brand is collateral only at best, and who knows the mechanical difficulties involved in the construction of the goods at second-hand merely, has no such inducement to stand up against odds in the fight for quality. On the contrary, as he can often change from one maker to another at will, without the public being any the wiser, manufacturers who would otherwise make a stubborn fight for the preservation of quality, either through a feeling of irresponsibility, or through the pressure of competition, or fear of losing the contract, weaken on real quality, while retaining the appearance of it. As a result, the dealer, ignorant of the details of manufacture, flounders from one perplexity to another, and the public continues to suffer. In the end, perhaps, such consumers, from motives of self defence, are forced to ignore dealers altogether, and turn for relief to some manufacturer, who has spent years in learning how to make a certain tool, and who, having found out how to do it, has a reputation to lose on that tool.

The manufacturer who supposes that in assenting to such a substitution of brands, he escapes all responsibility, or loss is in serious error. The lower range of prices and confidence, that substitutions of this kind have a natural tendency to bring about, must inevitably react upon the prices of even the best goods.

Bad Heating and Ventilating in Shops and Factories.

The subject of ventilation in shops and factories is, as a rule, very much disregarded, although in this country the advantages of good ventilation in the departments referred to are given more consideration than in some European countries. Men generally partake largely of the surrounding influences, as, for instance, a man working in a small, damp, dingy shop (if he follows this course for a few years), when he comes out at the close of working hours has a very different appearance and makes a very different impression (upon the beholder) from his neighbor who works in a well lighted and comfortable establishment over the way. A man who has to work in a shop where the light is poor, where it is hardly dark enough to use a light, will become morose and irritable and finally succumb to that much dreaded malady *consumption*. All buildings where manual labor is to be employed should be well lighted. It is customary in many railroad shops and some other shops, when new or repaired engines are ready to go out to fire them up in the shop.

This is one of the greatest punishments that can be inflicted upon the men in any shop, as the room will be filled with smoke a few minutes, and the men will be seen crying all about the shop. The nuisance is taken good naturedly at first, but their patience very soon becomes exhausted, and all those who can will leave the building while others will hold their positions and occupy the time in swearing instead of working, until the engine is removed. There is no economy in this proceeding, and there is a great loss to the concern interested every time it occurs. A little consideration and ingenuity is all that is necessary to avoid all the trouble referred to. We remember a railroad shop in particular where the scene described took place repeatedly, until it was proposed to do something to obviate the difficulty. A 2" iron pipe was accordingly connected with the boiler of the stationary engine in the shop, running overhead, and along the walls with a branch pipe and valve at each of the pits and other places where steam is to be required. When a locomotive boiler is ready to be tested, a connection is made by suitable connections to one of the branches referred to, and steam is let into the boiler. Should there be any leaks, or should any of the tubes be imperfect as is often the case, the boiler may be relieved in a few moments, and the necessary repairs made at once, whereas if the boiler had to be filled with water and fired up, then when the pressure arose, the leaks becoming apparent, the fire would have to be hauled, and the water let out causing a great loss of time and much expense. Sometimes the leaks do not appear when the boiler is filled with steam only, so after testing with steam alone and no leaks appear, the boiler is then filled with water, by means of an injector which is attached to the pipe which connects with the branch before mentioned.

While these tests and repairs are being made the men about the shop proceed with their work as if nothing unusual was taking place. The roof of the shop is white-washed, which of course adds to the light and cheerfulness of the shop. It is unnecessary to attempt to describe the immense loss of time which would inevitably occur if fire were used under the boiler being tested, for these disadvantages will suggest themselves to every inquiring mind. When a locomotive is ready to leave the shop a connection is made to the branch pipe, the boiler filled with steam, then with water, by means of the injector, after which the engine is moved out of the shop. The fire may then be started, and by the application of the blower everything may be soon ready for the trial trip.

A few words may be said right here about the construction of benches. It is customary to place the steam pipes for heating the shop under the benches, and the heat must necessarily pass out at the front of the bench. We have observed the men in a shop where this plan was adopted leaning up against the benches or their vises, and in several cases the men were nearly asleep, or so near it that they would occasionally stop their work and nod, being stupefied by the heat from the pipes. This is but an outline of what occurs all over the country, but it is all wrong, and the sooner steps are taken to remedy this evil the better will it be for both employer and employe. When heating pipes are placed under the bench there should be an opening back of the bench to allow the heat to pass up near the wall, instead of raising the dust and filthy odors from the floor up into the face of the workman. The circulation of fresh air in shops is generally neglected, when it is of such vital importance to both employers and employes. We are acquainted with a company whose shop is provided with a blower having a purifier attached, which supplies such quantities of pure air that the temperature in the shop referred to even in the hottest day in summer is from 48° to 50° Fahrenheit. It is indeed a pleasure for men to work in such a shop, and the amount of work done there is nearly double that done in some of the neighboring shops. These are suggestions which are worthy of the consideration of every manufacturer in the country, and if in publishing this information we are successful in awakening a sincere desire for investigation and improvement our anticipations will have been fully realized.

The Cincinnati Exposition.

The Cincinnati Industrial Exposition has for some years been one of the very best conducted and instructive autumn displays of industrial products in this country. The eighth national exhibition of art and industry will open in the grand permanent buildings erected for the purpose in Cincinnati, September 8th, and close October 9th. In our issue of August 16th last we gave an illustration and a brief description of the buildings. These exhibitions are not undertaken for pecuniary gain. There are no stockholders and no dividends. The Chamber of Commerce, Board of Trade and Ohio Mechanics' Institute unite in appointing a Board of Fifteen Commissioners to manage the fairs for and in behalf of the citizens of Cincinnati. The latter guarantee a fund (this year amounting to over $100,000) which is subscribed by the public at large. In 1879 the exhibition had exhibitors from 24 states, and was attended by 422,957 visitors. Preparations this year seem to warrant that it will be fully equal to any of the seven heretofore held in magnitude, variety, and every other particular. There is no charge for space or motive power. One of the most interesting features will be the display of machinery in operation and manufacturing processes.

There are thirteen departments and a good list of premiums. The first department is that of machinery, and is divided as follows:

CLASS 1.—Stationary Motors and Appurtenances, including Engines operated by Steam, Air, Gas, or other Motive Power, excepting Water and Electricity.

CLASS 2.—Steam Generators and Appurtenances.

CLASS 3.—Locomotors, including Portable and Traction Engines, Railway Rolling Stock and Appurtenances.

CLASS 4.—Hydraulic Machinery, including Hand and Steam Pumps, Hydraulic Presses, Water Motors, and Machines for Elevating and Utilizing Water for Mechanical Purposes.

CLASS 5.—Metal-Working Machinery, Tools and Appliances.
CLASS 6.—Wood-Working Machinery, Tools and Appliances.
CLASS 7.—Printing and Paper Machinery, Tools and Appliances.
CLASS 8.—Leather-Working Machinery, Tools and Appliances.
CLASS 9.—Pneumatic Machinery, including Pressure Blowers, Power Fans, Bellows, Air Pumps, etc.
CLASS 10.—Laundry Machinery and Appliances.
CLASS 11.—Tobacco Machinery.
CLASS 12.—Marine and Submarine Machinery and Appliances, including Models of Vessels, Life Saving Apparatus, Dredging Apparatus, Diving Bells, Snagboat Apparatus, etc.
CLASS 13.—Fire Engines, Fire Extinguishing Apparatus and Appliances, including Life Saving Apparatus.
CLASS 14.—Agricultural Machinery and Appliances.
CLASS 15.—Cane and Cider Mills, Sugar making Machinery and Apparatus.
CLASS 16.—Grist Mill Machinery, Grinding and Feed Mills, Grain and Flour Machinery and Appliances.
CLASS 17.—Miscellaneous Machinery and Appliances.
CLASS 18.—Textile Machinery. [To be under the supervision and control of the Committee on Textile Fabrics, and exhibited in connection with that department].
CLASS 19.—Working Models, exhibiting new advances in the Arts and Manufactures, not otherwise exhibited in the Exposition, subject to the approval of the Committee on Machinery, and for exhibition only.

Unknown Physical Forces.

There is one feature connected with the machinery department of the present census that we hope will receive its full share of attention. The particular branch that we have in mind is some accurate statement of the number and characteristics of the "mysterious" forces, that, according to some able, but slightly befogged engineers, play the mischief with the interior of steam boilers every now and then. Whether one of the enigmatical sprites, described by these experts, inhabits each steam boiler in the land, or whether a few of these

Black spirits and white, blue spirits and gray,

flitting about, now in one locality and now in another, are able at will to double up their capabilities of raising a disturbance whenever they take a vicious fancy, are surely questions important enough to deserve the attention of the census taker. Next to knowing how much we have been hurt, financially and physically, by boiler explosions, it is important, if possible, to know what hurt us.

Notes of the Press.

(*From the Bridgeport Daily Standard.*)

Mechanics and others interested in mechanical matters, will find in the AMERICAN MACHINIST for May 15th, much valuable matter. "Mechanical Confusion," by Charles A. Hague; "Hints on Lathe Tools," by William Main; "Extracts from Chordal's Letters;" Practical Draughting," by T. P. Pemberton; "Bearings for Machinery," by F. A. Pratt; and other contributed and editorial articles are all excellent. The illustrations also are up to the highest standard.

(*From Southern Poultry Journal.*)

We welcome the AMERICAN MACHINIST to our exchange list. It is elegantly gotten up, with illustrations in the finest work of art, on fine paper and clear type. No mechanic, or indeed others engaged in any branch of mechanical art, which the title of the journal designs to promote the interest of, should be without it. Subscription $3.00 per annum. Send for sample copy.

(*From Y Wasg, Pitsburgh, Pa.*)

Mae yr AMERICAN MACHINIST, a ddygir allan yn 96 Fulton Street, New York, yn parhan i enill tir. Myneg'r fod ei gylchrediad yn cynyddu yn hynod gyflym' a phrif gelfyddydwyr y wlad yn cymeryd dyddordeb ynddo. Mae y darluniau o'r dyfeisiadau diweddaraf mewn peirianwaith, &c., o'r radd flaenaf. Digon i'r darllenydd deallgar, er gweled gweith y cyhoeddiad hwn, ydyw i ni nodi ychydig o i erthyglau. Yr wythnos hon ymdrinir yn ei golofnau ar "Mechanical Confusion," "Balky Locomotives," "Moral Power of Machinery," yn nghyd ag ugeiniau o bethau buddiol eraill.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. P. O., Brooklyn, N.Y., asks: Will you be so kind as to inform me what ought to be the proportions of a 12-horse power horizontal tubular boiler, number and size of tubes, proper thickness of iron, and best setting? Pressure intended to be carried is 75 lbs. per square inch. Would you suggest a steel boiler? *A.*—The shell of the boiler should be of steel, double riveted, 32 in. diameter, 10 feet long, with 22 2½ inch tubes. There should be six (6) square feet of grate surface; with good fuel and draught 5 square feet will answer. The setting should conform with drawing of boiler setting of 200-horse power boiler lately published in the AMERICAN MACHINIST.

(2) G. D., Providence, R. I., asks: Will you please give me the rule for finding the pitch of a worm, for a worm-gear? Suppose the pitch of gear to be 14 to an inch, what should be the pitch of a worm to run in it? *A.*—We refer you to an article entitled "Operation of the Worm and Wheel," by Hermann T. C. Kraus, which appeared in our issue for Feb. 7, 1880. The method of laying out a worm and wheel is practically illustrated by Fig. 5, where it will be found that the pitch of the worm and diametrical pitch of the gear are alike.

(3) J. B., St. Louis, Mo., writes: I would be much obliged if you will give me the exact method of straightening thin wire? The common way, I believe, is in pulling the wire through, or between pins placed in a zig-zag position, but I do not know just how. *A.*—The best way to straighten a large quantity of small wire is by the use of a straightener, which consists of a small pulley placed upon a hollow shaft, and driven by a belt. There are usually six dies (adjustable by screws), placed three on each side, opposite to and in line with each other. The two dies at each end are adjusted in the center so that they will freely admit the wire to be straightened, while the middle dies are set out of the center until the wire when run through the hole, will be straightened by the revolving dies. For stiff or spring wire five dies are necessarily better than three. A cheaper tool is made by placing a series of rollers upon two adjoining plates at right angles to each other. These rollers number from 4 to 6 upon each plate, and are adjustable by set screws. Wire may be straightened by passing it between the rollers.

(4) H. Y., Easton, Pa., asks: 1. What kind of metal is used for making metal patterns? *A.*—For small patterns, type metal is much used, as it does not shrink. It is also easy to work, and the shape may be altered with very little trouble. For large patterns cast iron is much preferred, and in fact the metal used depends much upon conditions and circumstances. 2. What kind of glue is the best? *A.*—We refer you to an article entitled "To Test Glue," contained in our issue for Jan. 17, 1880. 3. Please give me a rule for finding the curve of a circle of one hundred feet radius without using the beam compasses. *A.*—The curve of any circle may be found (the diameter and chord of circle being known) by taking the length of the chord *f g*, Fig. 1,

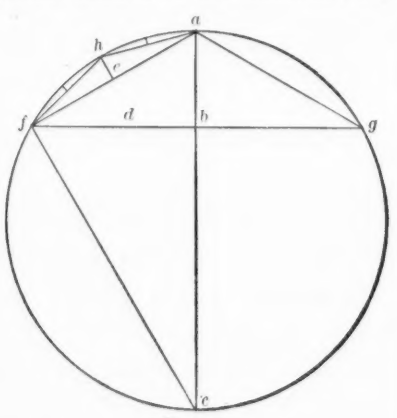


FIG. 1.

and finding the versed sine *a b*, then finding the versed sine of each of the chords *a f* and *a g*, then the versed sine of each of the chords *h a* and *h f*; thus finding any desired number of points in the circle. A line drawn, touching the ends of the versed sines thus found, will form the circle required. Let *a b*=the versed sine *a c*, the diameter of circle, and *d* half the length of chord. The formula will then be $ab=\frac{1}{2}(ac+\sqrt{-4d^2+(ac^2)})$. The rule to find the versed sine of any chord is: Extract the square root of the difference between the square of the diameter, and 4 times the square of half the chord. To this add the diameter of circle and take half this sum for the versed sine required. To avoid mathematical formulas the circle required may be drawn to any convenient scale, as shown in Fig. 2. From the center *a* with the given radius *a b* describe the circular arc *c d b*, draw the chord *c b*. Divide this chord into

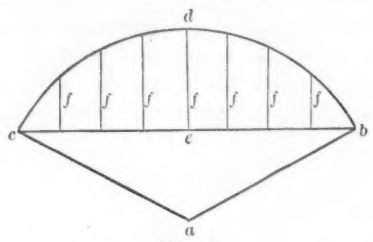


FIG. 2.

any number of equal parts, and draw the ordinates *fff* perpendicular to the chord *c b*. By measuring the length of each of the ordinates with a scale, you can lay out the curve very easily, and near enough for all practical purposes.

(5) G. W. M., Rutland, Vt., writes: I wish to know if the State of New York now offer a prize for the best method of canal navigation, which will not destroy the banks of the canal. Please name the requirements and conditions, if there be any. *A.*—In 1871 or 1872 there was an act passed by the Legislature of the State of New York, offering a premium of $100,000 for the best method of canal navigation by steam, and subject to certain conditions, the principal one being that there must be no damage done to the banks by washing. The boats were required to carry 200 tons, and travel at a speed of not less than 3 miles per hour. They were also required to enter and leave the locks without poling or towing. There were several competitors for the prize named, but none of the inventions produced fulfilled the specified requirements, therefore the report offered by the Commissioners was against making any awards under the Act passed by the Legislature; but to encourage inventors, recommended that an Act be passed providing a subsidy of $5,000 be offered for ten boats built. This appropriation was made to pay in part the expenses of the inventors. There was a disbursement made under the subsidy act amounting to $55,000, the original offer being of course withdrawn. There is at present no premium offered by the State of New York for the best method of canal navigation by steam, but there is at present a good opportunity for successful inventions.

Business Specials.

40 cts. a line for each insertion under this head.

Messrs. Brown & Brothers, Waterbury, Conn., write: "Having used a No. 5 Pulsometer for a period of more than six years, for raising water about 35 feet, we consider it the best pump we have ever used." Send for a new book on the Pulsometer. Office, 40 John Street, New York,

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathes, and Watch Machinery.

Vertical and Horizontal Pumps. Capacity from 100 to 35,000 galls. per minute. Simple, Efficient, Economical, Durable. Used by more than half the tanners and paper makers of the country. Horizontal and Vertical ENGINES, from 10 to 30 H. P., for long continued hard work. Prices, 40 per cent. below other makers. Send for circulars. Heald, Sisco & Co., Baldwinsville, N. Y.

Dixon's Traction Belt Grease. Dixon's Founders' Perfect Wash. Dixon's Plumbago Foundry Facing. Dixon's Graphite Machine Grease. Dixon's Everlasting Graphite Axle Grease. Dixon's Dry American Graphite Perfect Lubricator. Send for explanatory circular to Dixon Crucible Co., Jersey City, N. J.

Portland Cement. S. L. Merchant, 41 Broadway, N. Y. city. Remit 35c. postage for Treatise to use it.

For Schaffer & Budenberg's celebrated Steam Pressure, Hydraulic and Vacuum Gauges, Engine Counters, Pyrometers, Thermometers, Reducing Valves, Superior Crystal Gauge Glasses, etc., address W. Heuermann, 40 John Street, New York.

See Standard Turbine advertisement next number.

Wanted.—A "Gwynn Pump" and a "Gwynn Pumping Engine," as built in this country in 1848-1856. Willing to pay liberal price for one or both. Samuel S. Webber, 204 and 206 Green street, New York.

Dies for every purpose. Stiles & Parker Press Co., Middletown, Conn.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, 65 Henry Street, Brooklyn N. Y.

A new automatic valve gear for steam engines complete. Address, Ed. F. Williams, P. O. Box 148, Leadville, Colorado.

Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Norris & Rutter, Mechanical Draughtsmen and Patent Solicitors, 424 Walnut Street, Philadelphia.

To Manufacturers and others: We are prepared to build all kinds of machinery. Patent Articles a Specialty. Correspondence Invited. Mather & Newitt, Practical Machinists, Leominster, Mass.

John Fish, M. E. Air Compressors and Working Drawings a specialty. Room 23, 10 Pine St., New York.

W. Barnet Le Van, Mechanical and Consulting Engineer, 3607 Baring Street, Philadelphia, Pa.

Rare opportunity to purchase a complete set of the "Encyclopædia Britannica," 8th edition. Twenty-three books, bound in cloth, at $55. Address, J. F., care American Machinist, 96 Fulton Street, N. Y.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at Washburn, Hunts and Co. Wheel Foundry, cor. Warren and Bay Sts., Jersey City, N. J.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Second-hand 80 H. P. Tubular Boiler for sale cheap; also one large Blower. David W. Pond, Worcester, Mass.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

MANUFACTURES.

The Chaplin Anti-friction Car Box Company propose to build a factory at New Haven, Conn., provided a suitable site can be secured.,

The Southwark Foundry & Machine Co., of Philadelphia, builders of the Porter-Allen high speed engine, are full of orders and are engaging all the first-class machinists that apply for work.

Wm. Sellers & Co., Philadelphia, are crowded with orders for machine tools and find it difficult to obtain enough first-class machinists.

At the Australian Exhibition, Sydney, a special order of merit has been accorded to J. A. Fay & Co., Cincinnati, for wood working machinery.

The Whitehead & Atherton Machine Company of Lowell, Mass., has been incorporated with a capital of $50,000.

A company has been organized at Kansas City, Mo., with $50,000, to build smelting works.

Winston, Merrell & Co. are to manufacture patent railway frogs in Chicago, Ill.

Rumsey & Co., proprietors of the Seneca Falls Pump and Fire Engine Works, at Seneca Falls, N. Y., are about to build an addition to their works. The new building will be 34x36 and five stories high. It will greatly increase the manufacturing facilities of the company.

The Victor Feed Water Heater and Purifier, made by Wm. Allen & Sons, Worcester, Mass., is at work in many localities with the best results. It clears the water from some of the most troublesome substances to get rid of.

The Stevens Filter Co., Toledo, O., was organized May 15, 1880, capital stock, $25,000 paid up. J. H. Davis, President; A. G. Williams, Treasurer; Walter Pickins, Secretary. Ten thousand filters will be turned out this year.

W. D. Lee and associates purpose building a large blast furnace on the Herrold Iron Estate at Floodwood, O., on the Columbus and Hocking Valley Road.

The Webster, Camp & Lane Machine Company of Akron, O., are very busy, running twelve hours a day with a force of seventy men.

The Diebold Safe and Lock Company of Canton, Ohio, are to build large additions to their works this summer.

H. D. Fearing & Co., Amherst, Mass., will rebuild; main building to be 180 feet long, 60 feet wide and four stories high, of brick. There will also be a large brick storehouse, boiler-house, machine shop, bleachery, dye-house and smoke house.

The Nonotuck Paper Company have organized at Holyoke, Mass. The new mill will be about the size of the Wauregan.

The foundations have been begun for a new brick building 100 feet long, on the site of the old Green River Foundry Works, at Greenfield, Mass. A 25 horse-power engine and a water-wheel will be put in, and the establishment will be used for light manufacturing purposes.

The Cuyahoga Works of Cleveland have just started the 84" blowing engine, built by them for the Mahoning Valley Iron Co., of Youngstown, and will next week begin the errection of a similar engine for the firm of Brown, Bonnell & Co., of the same place.

Machinists' and Engineers' Supplies.

NEW YORK, June 3d, 1880.

The supply market continues dull, with no changes worthy of notice. It is thought that prices have reached the lowest point, and that the next change will be upward.

Wrought iron pipe is a little stiffer this week, but the prices are unchanged. The manufacturers, we understand, are to hold a meeting to-day, at which it is expected there will be an effort to raise the prices.

The manufacturers of sheet Brass and Copper are to hold a meeting to-day, and there is a rumor that another reduction on list prices will be made.

Wm. Sellers & Co., of Philadelphia, have advanced the list prices of their tools, such as lathes, planers, etc., about 3 per cent., and have issued a new list.

Frasse & Co., 62 Chatham St., have taken the New York agency for George B. Grant's spur, miter, bevel, internal skew-bevel and worm gears, also worms and racks. This class of goods is particularly adapted to machinists, model makers and others who use experimental machinery. The general sizes are kept in stock, while the special sizes are made to order.

Goodnow & Wightman, 175 Washington Street, Boston, Mass., have advanced the prices of their three-feet engine lathes from $110 to $125 as a basis. Larger sizes have been advanced in proportion.

The following circular has just been issued, and explains itself:

To our Customers and the Trade—

As an impression seems to exist among our customers and friends, in consequence of the announcement of another party, that we do not intend to furnish our manufacture of taps, dies, etc., any longer, we desire to correct the same.

We are prepared to supply our make of tools as in the past.

The quality of our taps, which has given them their wide reputation, will be carefully preserved.

Respectfully,
H. PRENTISS & COMPANY.

14 Dey St., New York, June 3, 1880.

We have received a copy of a new catalogue and price list of the Billings & Spencer Co., Hartford, Conn. It contains 40 pages, and is fully illustrated. We quote as follows from the preface:

"As a specialty, the Drop Forging business is followed by very few concerns in the world, and there are none in the United States making in any comparison the amount and variety made by this company. Upwards of 1,000 different articles for parts of Guns, Pistols, Sewing Machines, Special Machinery, Machinists' Tools, Sewing Machine Shuttles, are among the Drop Forgings. A large variety of goods are also put on the market in a finished state, by the company, among which may be mentioned the following, viz.: Billings' Patent Screw Plates and Dies, Tap and Reamer Wrenches, Lathe Dogs in 12 sizes from ⅜ to 4 inches, Billings' Adjustable Pocket Wrench, Barwick Wrenches, Screw Drivers from best tool steel, Thread Cutting Tools, Billings' Improved double-action Ratchet Drills with sockets for using Morse Taper Shank Twist Drills, or the old-fashioned Square Shank Drills, Five sizes Packer Ratchet Drills, about 30 varieties of Sewing Machine Shuttles for the different makes of Sewing Machines in this country and Europe."

Iron Review.

NEW YORK, June 3d, 1880.

Pierson & Co., 24 Broadway, N. Y., under date of June 3, 1880, quote nominal prices out of store as follows:

Pig Iron remains dull and without material change in price from last week.

Bar Iron is in fair demand, but somewhat unsettled.

Iron Rails, $52½ to $57½, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3¾c.; Common Bar Iron, nominal, 2 7-10c., basis from store; Refined do. 3c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 6¾c.; Sheet Iron, 4c., basis; Angle Iron, 3 6-10c.; Tee Iron, 4¼c.; Band Iron, 3½c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 5c.; C. H. No. 1 Shell, 3¾c.; Tank, 3c.; C. No. 1, 3½c.; Boiler Tubes, 52½% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of June 3d, 1880:

A very fair business in jobbing way prevails in metals; prices still favor buyers. Pig Tin down to £70 in London, and $22 in Singapore. Would quote this market nominally. Banca Tin 20c.; Malacca and Straits 16c; Australian and English Refined 15¾c.; Billiton 15½c.; Lamb and Flag 16½c.; Pig Lead 4¾c.; Antimony 19c. to 19½c. for Cookson, 17c. to 17½c. for Hallett Spelter; 5¾c. for Domestic; 6c. for Foreign. Ingot Copper 18½c.; Nickel $1.25; No. 1 Solder 10c.; "half-and-half" 11½c.

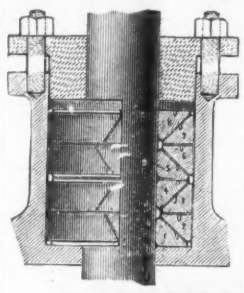
WANTED.

Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

Wanted.—Screw Press to cut 1½×1×⅛ wrot. Price and condition; 168 Light street Baltimore, Md.

Wanted.—Twenty to thirty good machinists. Address, Pratt & Whitney Co., Hartford, Conn.

CARMICHAEL & EMMENS,
130, 132 & 134 Cedar Street, New York,
DEALERS IN
Iron and Steel Boiler Plate,
LAP WELDED BOILER TUBES, &c., &c.
Agent for Otis Celebrated Cast Steel Boiler Plates; the Coatesville Iron Co.; Pottstown Iron Co.; the Laurel Rolling Mills and Union Tube Works.
Wrought Iron Beams, Angles, Tees, Rivets, &c.



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For Piston Rods, Valve Stems, &c.
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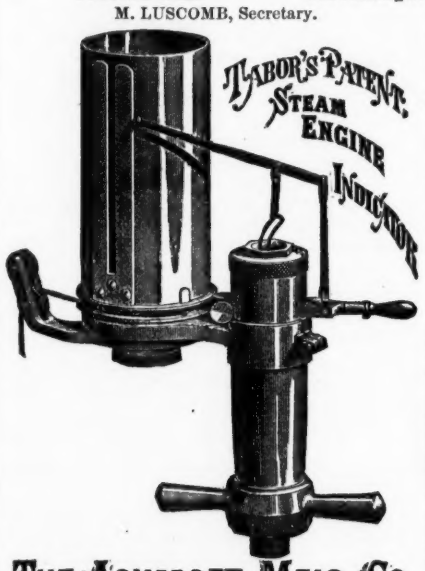

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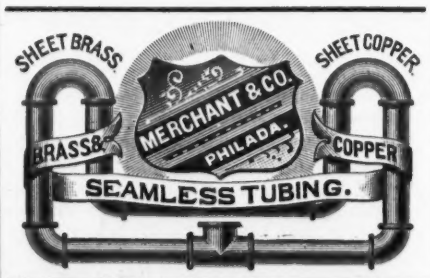
CAUTION.—As we are in no way connected or interested with any other Steam Gauge Manufacturer, parties ordering goods should be particular and address. THE ASHCROFT MANUFACTURING CO., 51 and 53 Sudbury Street, Boston, Mass.



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HALL'S PATENT
Compound Lever Cutting Nippers.
Every pair Warranted to Cut Steel Wire.
Worn or Damaged Parts can be replaced at a trifling cost.
Manufactured ENTIRELY OF STEEL by
THE INTERCHANGEABLE TOOL COMPANY,
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For sale by all dealers in Machinists' Tools and Hardware. Send for Price List

FOR SALE.
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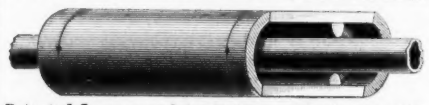

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We claim a larger percentage of saving in condensation than any other covering; greater rapidity and cheapness of application; greater durability, and a neater and better finish when completed. It is especially adapted for shipment to the country. This covering can be easily removed and replaced in case of change in the pipes or for inspection of boilers and used over again. Hair Felt, Plastic and Cement Coverings of the best quality. **Covering of outdoor and underground Pipe a Specialty.**
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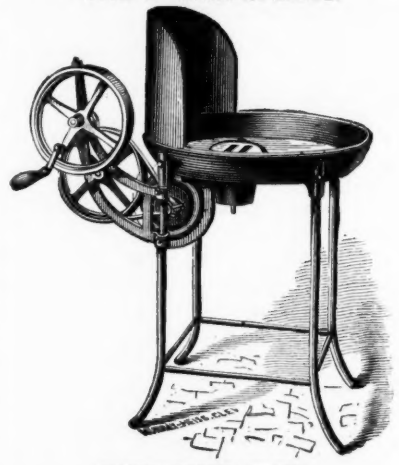
With or Without Hood.



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Office, No. 78 Chambers Street, N. Y. **Full Weight Hand-Cut Files.** Manufactory, PATERSON, N. J.
The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonial. Read it.
FARREL FOUNDRY AND MACHINE CO.
Jas. D. Foot, Esq., Waterbury, Conn., Nov. 8th, 1878.
Dear Sir;—Please forward the order for Files given you a few days since.
Your Files have been uniformly satisfactory to us. Yours respectfully,
FARREL FOUNDRY & MACHINE CO., E. C. LEWIS, Ag't.
We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.
Respectfully, **KEARNEY & FOOT.**

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Feed Water Heater and Filter,
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MORTON, REED & CO., Baltimore
FRANK H. POND, 709 Market St., St. Louis.
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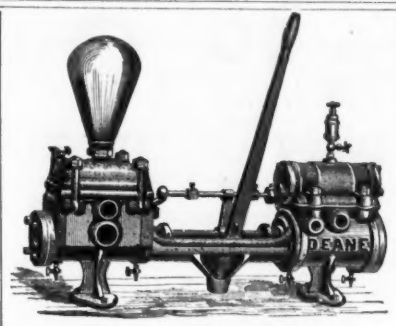

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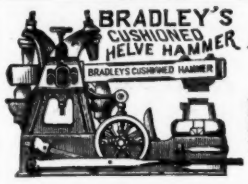

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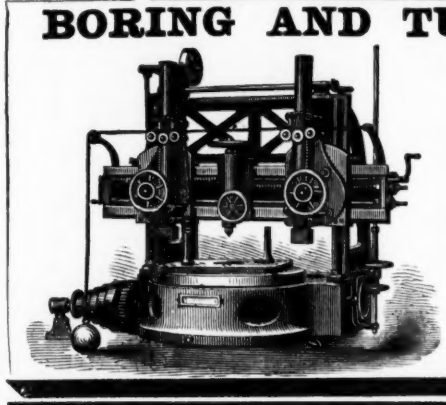

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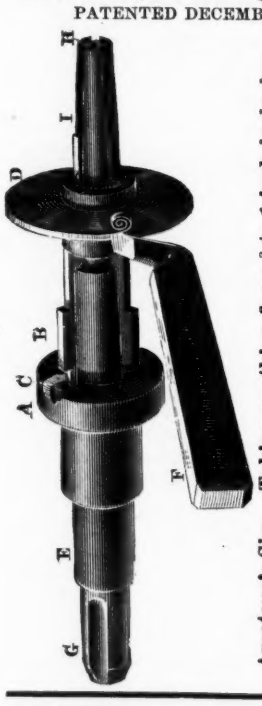

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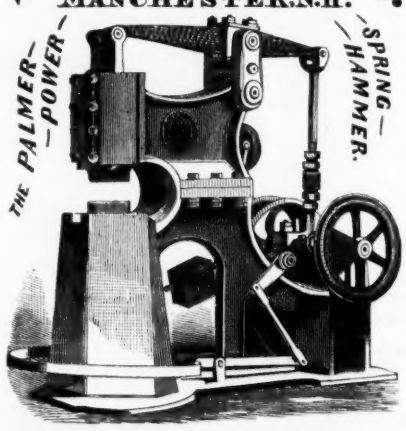

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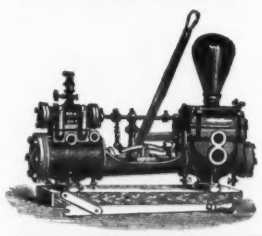

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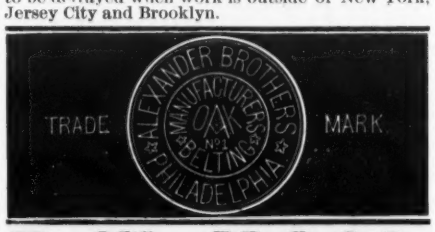

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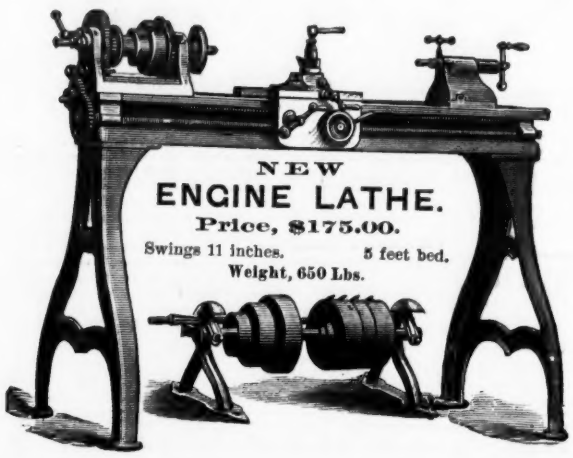

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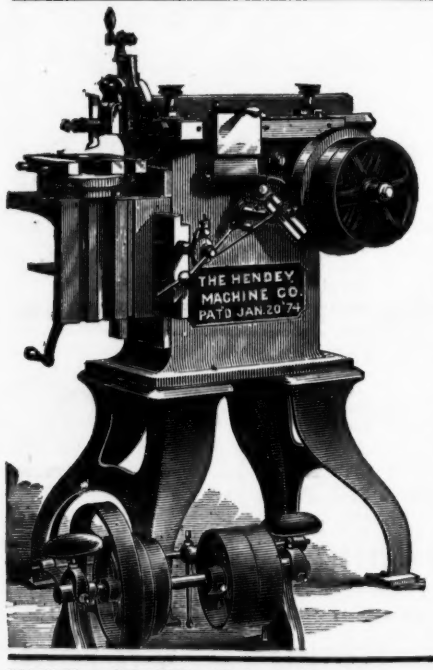

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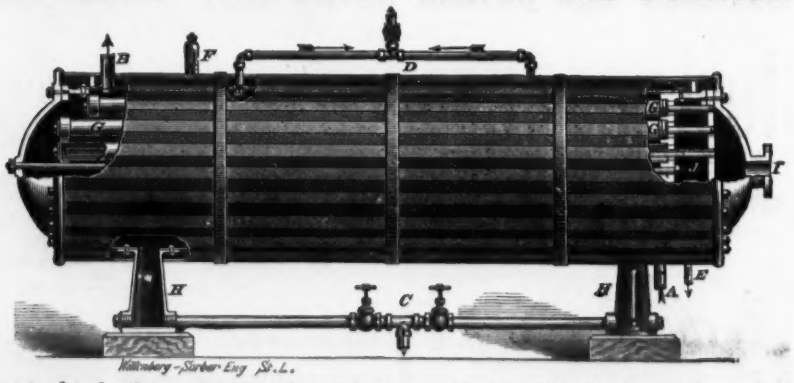

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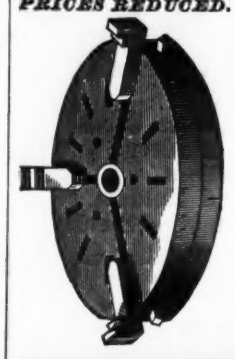

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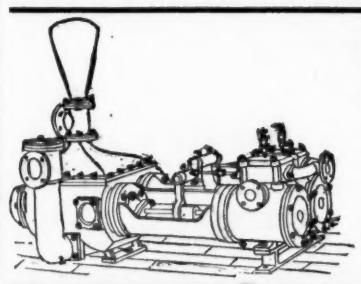

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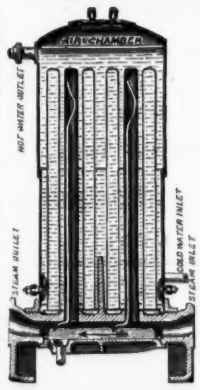

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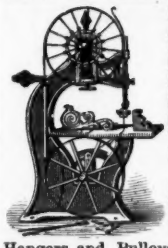

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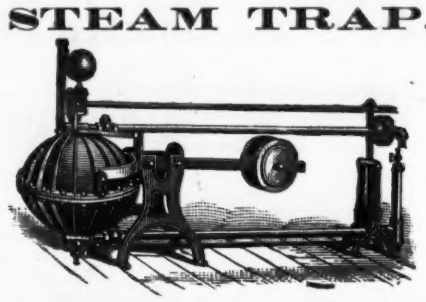

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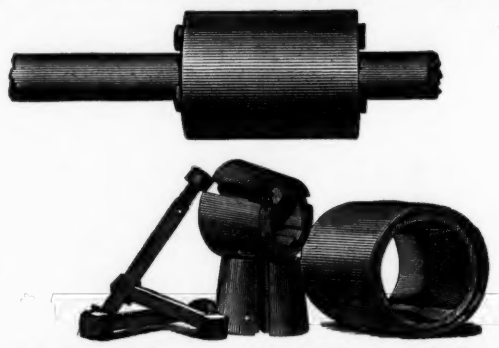

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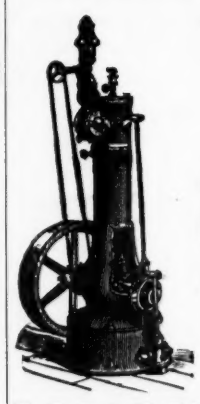

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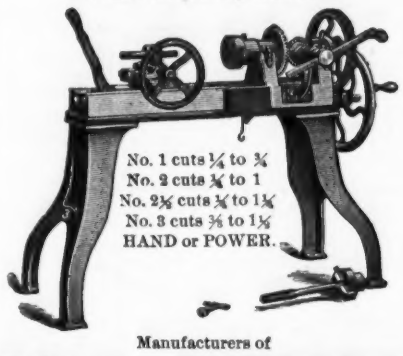

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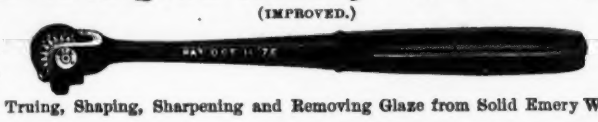

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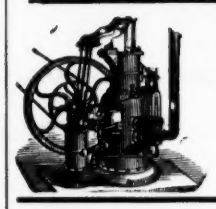

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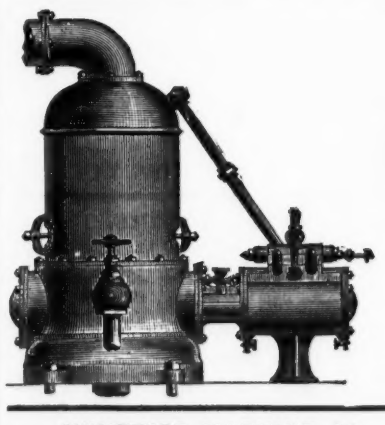

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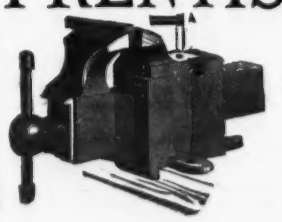

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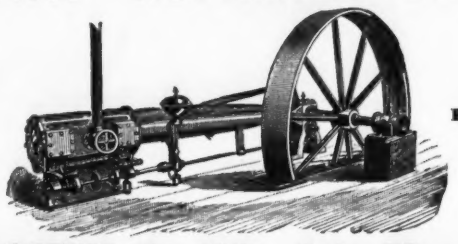

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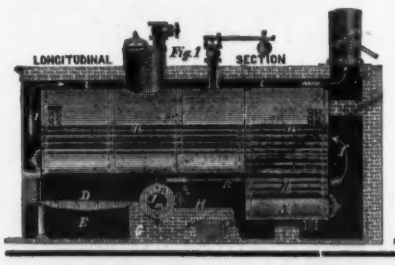

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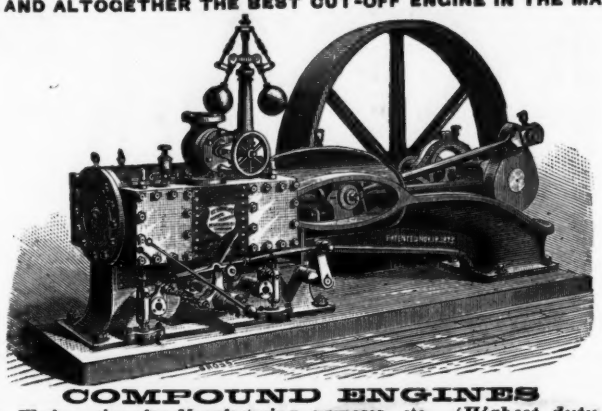

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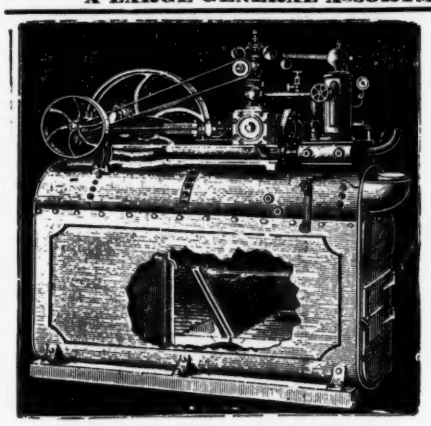

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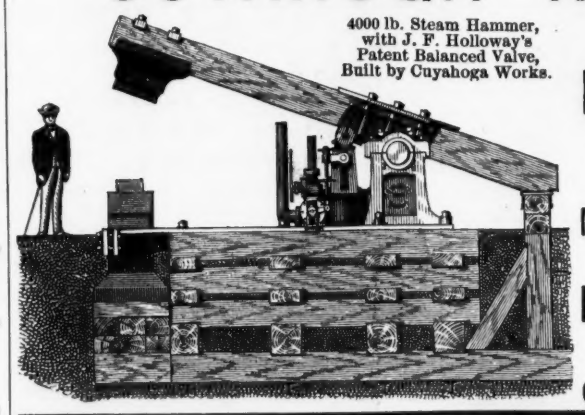

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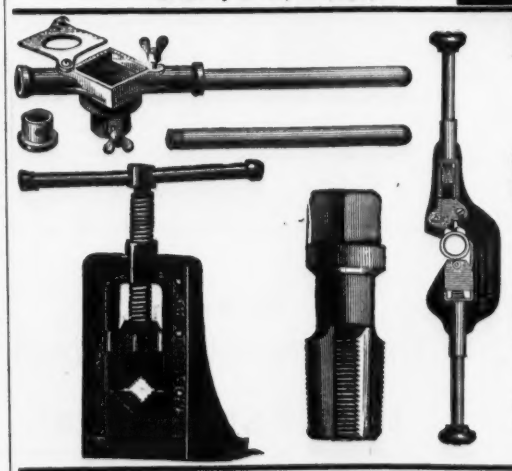

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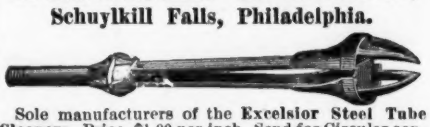

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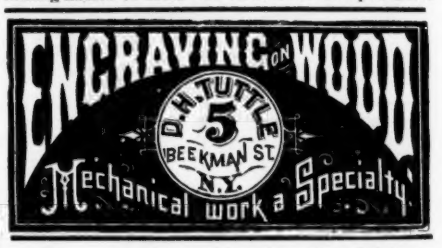

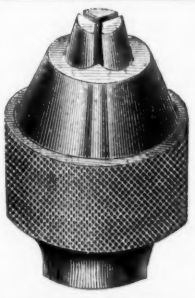

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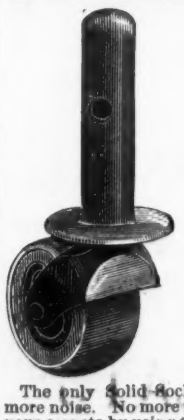

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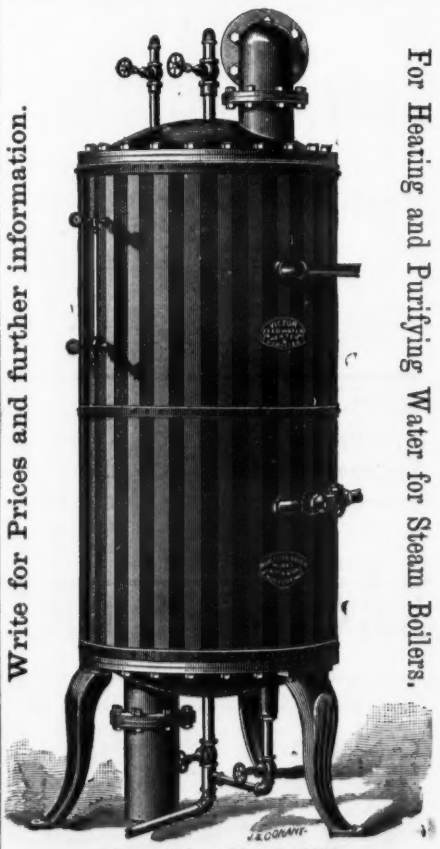

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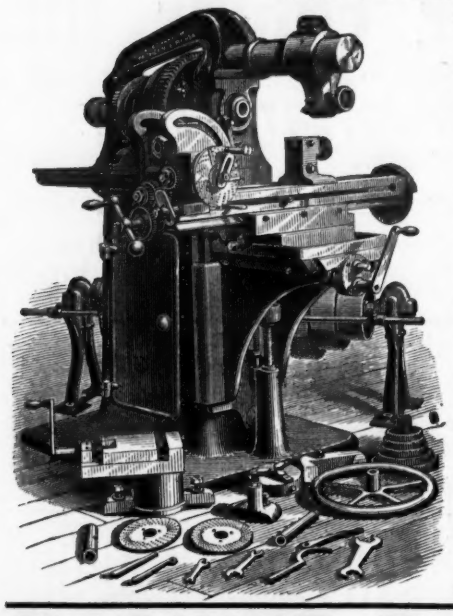

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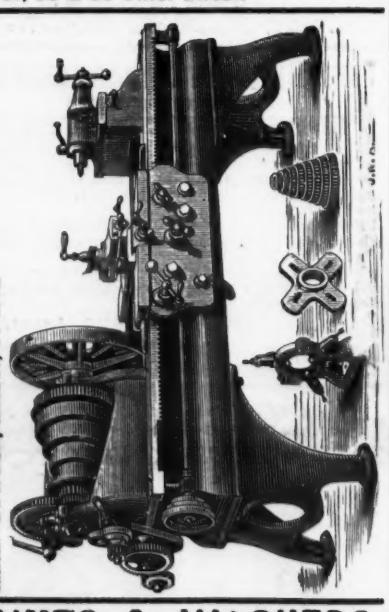

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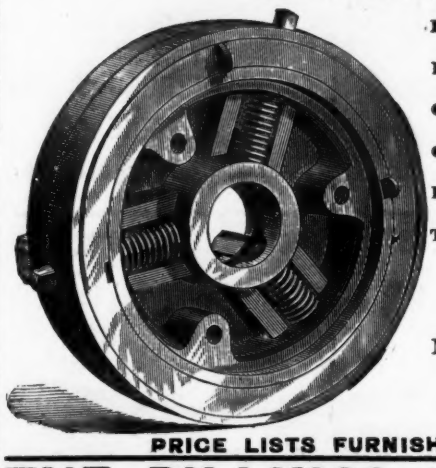

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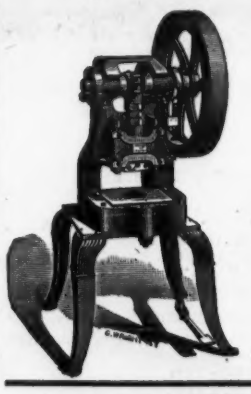

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